03 MAY 2001

FORM PTO-1390 (REV. 11-2000) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

KET NUMBER

U.S. APPLICATION NO. (If known, see 37 CFR 1.5

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/CA99/01020	3 NOVEMBER 1999	10 NOVEMBER 1998

TITLE OF INVENTION PROOF THAT THE CONTRACTION OF THE CALF CANNOT INCREASE PRESSURE ON THE PEDAL AND MECHANISMS CAPITALIZING ON THIS FUNDAMENTAL DISCOVERY

APPLICANT(S) FOR DO/EO/US ANDRÉ JACQUES

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below.
4. ☐ The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. ☐ is attached hereto (required only if not communicated by the International Bureau).
   b. ☒ has been communicated by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
   a. ☒ is attached hereto.
   b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☒ Amendments to the claims of the International Aplication under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. ☐ are attached hereto (required only if not communicated by the International Bureau).
   b. ☒ have been communicated by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☐ have not been made and will not be made.
8. ☒ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371 (c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ An English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11 to 20 below concern document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☐ A FIRST preliminary amendment.
14. ☐ A SECOND or SUBSEQUENT preliminary amendment.
15. ☐ A substitute specification.
16. ☐ A change of power of attorney and/or address letter.
17. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
18. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).
19. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
20. ☐ Other items or information:

U.S. APPLICATION NO. (if known, see 37 CFR 1.5)	INTERNATIONAL APPLICATION NO. PCT/CA99/01020	ATTORNEY'S DOCKET NUMBER

21. ☒ The following fees are submitted:

	CALCULATIONS	PTO USE ONLY
BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)):		
Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO $1000.00		
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO $860.00		
International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO $710.00		
International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) $690.00		
International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) $100.00		
ENTER APPROPRIATE BASIC FEE AMOUNT =	$ 860.00	
Surcharge of $130.00 for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).	$ 0.00	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE	CALCULATIONS	PTO USE ONLY
Total claims	9 -20 =	0	x $18.00	$ 0.00	
Independent claims	9 -3 =	6	x $80.00	$ 480.00	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ $270.00	$ 0.00	
TOTAL OF ABOVE CALCULATIONS =				$ 1340.00	
☐ Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2. +				$ 670.00	
SUBTOTAL =				$ 670.00	
Processing fee of $130.00 for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)).				$ 0.00	
TOTAL NATIONAL FEE =				$ 670.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). $40.00 per property +				$ 0.00	
TOTAL FEES ENCLOSED =				$ 670.00	
				Amount to be refunded:	$
				charged:	$

a. ☒ A check in the amount of $ 670.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. ____________ in the amount of $ __________ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☐ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. __________. A duplicate copy of this sheet is enclosed.

d. ☐ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. **Credit card information should not be included on this form.** Provide credit card information and authorization on PTO-2038.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137 (a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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NAME

REGISTRATION NUMBER

PTO/SB/09 (12-97)
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Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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STATEMENT CLAIMING SMALL ENTITY STATUS (37 CFR 1.9(f) & 1.27(b))—INDEPENDENT INVENTOR

Docket Number (Optional)

Applicant, Patentee, or Identifier: ANDRÉ JACQUES

Application or Patent No.: PCT/CA99/01020

Filed or Issued: 11/03/1999

Title: PROOF THAT THE CONTRACTION OF THE CALF CANNOT INCREASE PRESSURE ON THE PEDAL AND MECHANISMS CAPITALIZING ON THIS FUNDAMENTAL DISCOVERY

As a below named inventor, I hereby state that I qualify as an independent inventor as defined in 37 CFR 1.9(c) for purposes of paying reduced fees to the Patent and Trademark Office described in:

- ☒ the specification filed herewith with title as listed above.
- ☒ the application identified above.
- ☐ the patent identified above.

I have not assigned, granted, conveyed, or licensed, and am under no obligation under contract or law to assign, grant, convey, or license, any rights in the invention to any person who would not qualify as an independent inventor under 37 CFR 1.9(c) if that person had made the invention, or to any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e).

Each person, concern, or organization to which I have assigned, granted, conveyed, or licensed or am under an obligation under contract or law to assign, grant, convey, or license any rights in the invention is listed below:

- ☒ No such person, concern, or organization exists.
- ☐ Each such person, concern, or organization is listed below.

Separate statements are required from each named person, concern, or organization having rights to the invention stating their status as small entities. (37 CFR 1.27)

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

	ANDRÉ JACQUES	
NAME OF INVENTOR	NAME OF INVENTOR	NAME OF INVENTOR
	André Jacques	
Signature of Inventor	Signature of Inventor	Signature of Inventor
	05/02/2001	
Date	Date	Date

[redacted]

PCT ORGANISATION MONDIALE DE LA PROPRIETE INTELLECTUELLE
Bureau international

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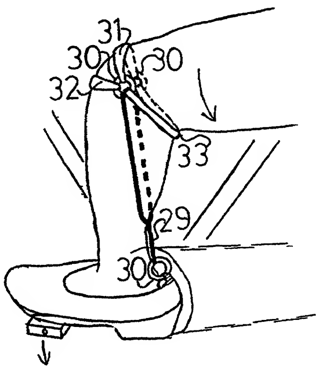
(54) Title: CRANKSET DEVICE

(54) Titre: DISPOSITIF POUR PEDALIER

(57) Abstract

To understand the present invention, it is first necessary to understand thoroughly the following discovery concerning the calf when pressure is applied on the pedal: there are two optical illusions which mislead everyone (figures 21 and 22 represent a lower limb pressing on a pedal, (6) being the thigh, (11) the leg, A+B the foot and (1) the ankle). The first illusion (fig 21) is to believe that the calf (M) increases the pressure on the pedal. The second illusion (fig 22) is not to see the force M' which cancels the force M. The entire pressure on the pedal is derived from the thigh only, the calf contraction being merely loss of energy. The invention consists in replacing the pedal by a mechanism avoiding the use of the calf thereby doubling performance without loss of power.



(57) Abrégé

Pour comprendre cette invention, il faut commencer par comprendre en profondeur la découverte suivante qui concerne le mollet quand on appuie sur une pédale, deux illusions d'optique trompant le monde entier (les fig 21 et 22 symbolisent un membre inférieur appuyant sur une pédale, (6) étant la cuisse, (11) la jambe, A+B le pied et (1) la cheville). La 1ère illusion (fig 21) est de croire que le mollet (M) augmente la pression sur la pédale. La deuxième illusion (fig 22) est de ne pas voir la force M' qui annule la force M. La totalité de la pression sur la pédale provient de la cuisse seulement, la contraction du mollet étant une perte d'énergie. L'invention consiste à remplacer la pédale par un mécanisme permettant d'éviter l'usage du mollet ce qui multiplie par deux le rendement sans perte de puissance.

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PROOF THAT THE CONTRACTION OF THE CALF CANNOT INCREASE THE PRESSURE ON THE PEDAL AND MECHANISMS TO MAKE USE OF THIS FUNDAMENTAL DISCOVERY.

The dominant characteristic of this invention will not be immediately be explained, however the very simple explanation that follows has the advantage of opening the reader's mind to the fact that "something" fundamentally important has been totally ignored by current cycling.

By incredible chance, the inventor has discovered that an error in visual interpretation (an optical illusion) has led everyone astray for 150 years, since the first pedals were used on bicycles! The text that immediately follows will not explain the nature of this optical illusion: the latter is very subtle and will be explained later in this document, only after additional explanations are given. THE PROBLEM: hills are enemy #1 to the cyclists.

Why is it so exhausting to climb a hill while pedalling in the standing position? Is there a solution to this problem? Is it possible to invent something which could DIVIDE BY TWO (at minimum) the energy required to climb a hill? That would be a miracle ...The surprising answer is YES, it is possible! (We will show later that this invention also allows to divide by two - at minimum- the energy consumption on flat terrain, when it is used in the seated position).

Below, we will only discuss the standing position on the hill. Refer to fig 1, 2, 3 and 4. Let's compare a cyclist climbing a hill while pedalling in the standing position to someone climbing stairs:

IT IS UNBELIEVABLY REVEALING AND FULL OF CONSEQUENCES...

Fig 1 illustrates the normal way of climbing stairs: we place the heel on the stair. Fig 2 shows the abnormal way of climbing stairs: we only place the tip of the foot on the stair, the heel free-floating, thus forcing the calf to exercise a tension on the heel of THREE TIMES the person's weight (evidently the calf does not exercise any tension in the case of fig 1). Why THREE TIMES, and not TWO or FOUR times?

Refer to fig 3: the A/B ratio is THREE, where A is the distance between the toe articulation (2) and the heel articulation (1), and B is the distance between (1) and the point of attachment (3) of the calf (4) on the heel bone (by the means of the Achilles' tendon).

Try this experiment: supposing that you have to climb stairs for 40 stories; begin the climb by placing the heels on the stairs as in fig 1: you are tired, but you manage to reach the top. The next day (to regain the lost energy), try climbing the 40 stories as in fig 2, that is on the tip of the foot, thus making the calves exercise a force equal to THREE TIMES your weight.

N.B: do the experiment under the same conditions as the day before (we must compare apples with apples), that is to say, climb at the same speed and, in between stories, do not rest by placing the heels on the ground.

According to you, how many stories will you be able to climb, spending the same energy as the day before? The limit that will be humanly impossible to exceed is TWENTY stories (therefore half of the 40 stories)! If you manage to climb up to the twentieth floor by keeping the heels free-floating, you will have spent MUCH MORE energy that the day you have climbed the 40 stories in a normal way; therefore, you spend TWICE AS MUCH energy (at minimum) by climbing stairs with heels free-floating than by climbing normally (heels on the stairs): we can state, without too much risk of error, that the real amount of energy spent with free-floating heels is probably THREE TIMES greater than while climbing in the normal way!

Refer to fig 4: it illustrates the foot of a cyclist CLIMBING A HILL while pedalling in the standing position. This position of the foot on the pedal is recommended by the experts: the toe joints rest on the pedal axis, while the HEEL IS FREE-FLOATING, thus forcing the calf to exert a force equal to THREE TIMES the weight of the cyclist, AS IS THE CASE IN FIG 2:

...climbing a hill while pedalling in the standing position is analogous to climbing stairs with the heels free-floating: fig 2 and 4 represent the same phenomenon...

Effectively, the foot GOES DOWN with respect to the bicycle frame, but since the bicycle GOES UP the hill, the net result is that the foot GOES UP with respect to the HILL: it is relative, as Albert Einstein would say...

THE MIRACLE: here is a fabulous statement: to REDUCE BY A FACTOR OF TWO (at minimum) the energy consumed for climbing a hill while pedalling in the standing position, all we need to do is to REPLACE THE PEDALS by "something" which SUPPORTS THE HEELS, in order to avoid exerting a force with the calves, thus realizing a fabulous energy savings without the loss of propulsive power!

There is no loss of power since the force utilized is always equal to the WEIGHT of the cyclist, whether the heels are supported or not: it is similar to fig 1 and 2: the force on the stairs is always equal to the weight of the person climbing, whether the heel rests on the stair or is free-floating.

How is it possible that nobody, in 150 years of cycling, has thought of replacing the pedals by platforms which support the foot? Because of an optical illusion that occurs when we observe a leg applying pressure on a pedal: this illusion has tricked everyone. If someone had thought of replacing pedals by platforms, there would not be any bicycles with pedals on the roads; since there are bikes with pedals on the roads, we are forces to conclude that no one has thought of it!

This optical illusion is extremely subtle and will be explained only after providing additional information; only a brief explanation will be given to put you "on the trail", i.e. to make you understand that this illusion is real, that it exists, without, however, explaining it in detail.

Try and erase from memory Fig 1 & 2, that is to say forget (temporarily) the comparison (stairs/cyclist pedalling in the standing position) that we just did; put yourself in the place of the man on the street and concentrate only on Fig 4 (the foot applying pressure on the pedal): according to you, is this drawing normal? Yes, of course: this is the standard image which has been impressed in our mind when we were young, as soon as we have seen a cyclist pedalling for the first time.

Fig 4 shows the normal position of the foot on the pedal, which is recommended by the experts: the toe joint rests on the pedal axis and the heel is free floating.

If you can't forget Fig 1 and 2 (the stairs), ask someone if they find Fig 4 normal (evidently without showing Fig 1 and 2 to that person): the response will definitely be "... yes, Fig 4 is quite normal....". The whole world (except the inventor) finds that Fig 4 represents a situation which is quite normal, and that includes ALL cycling experts.

Evidently, you know that Fig 4 is not normal since it is the equivalent of Fig 2 which is not normal. You know that Fig 4 is not normal because you have made a comparison with a totally independent second observation , that of the stairs.

If you do not make a comparison with a second phenomenon, you will never discover and fully realize that Fig 4 is not at all normal: without a second phenomenon to compare, you would be totally convinced that Fig 4 is normal as you have been as a youngster and that you would remain convinced all your life because you have been induced in error during your youth by this optical illusion!

This is a "hereditary" optical illusion which has been transmitted from generation to generation until today, starting about 150 years ago, as soon as the first pedals were used.

One of the goals of this document is to uncover this awful waste of energy which remains totally ignored for one and a half century: unbelievable, but true!

There is a great difference between being wrong (make a mistake) and being tricked against our will (or be induced to error) by an optical illusion. Before discovering this optical illusion, the inventor was tricked like everyone else, such as the experts, the scientists and the billions of individuals who have cycled or simply seen a cyclist pedalling...

This will give you an idea of the power of this optical illusion! Now you know why no one has thought beforehand of what this document contains: this famous optical illusion has created a powerful vicious circle which has completely prevented the understanding of the functioning of the leg when used to apply pressure on a pedal: this has held cycling in slavery for all this time...

You also understand why inventions that are based on the discovery of an optical illusion are truly revolutionary: this type of invention is very rare and the secret is self-protecting because of the very existence of the optical illusion. An optical illusion will not tell you that it is an optical illusion!: you must discover it and this can happen only once. Only one individual has discovered that the earth rotated on its axis, thus creating an optical illusion: one had the impression that the sun was moving across the sky by rising in the east and setting in the west; for thousands of years, the greatest scientists and billions of individuals were tricked and this illusion remained uncovered. We have a similar situation with the invention proposed here.

Without a doubt you are asking yourself this kind of question: what happens with this invention when, on flat terrain, one pedals in the seated position? etc...

You are probably asking yourself questions like: "what happens to this invention on flat terrain when pedalling in the seated position?" etc...

Do not try to answer these questions by yourself since you would fall back into the trap of the optical illusion that we want to reveal: it would be a vicious circle since, in trying to judge by yourself, you would inevitably use notions which have been imprinted in your mind since childhood, notions which you believe to be true while, in reality they are false!

For the moment, please be satisfied with the inventor's explanations and keep an open mind!

It is often said that "a picture is worth a 1000 words"; however, there is an exception to this rule: indeed, in the case of an invention which is born out of the discovery of an optical illusion, a drawing of the invention will trick us visually and lead us to believe that the invention is stupid or useless! We are far from the 1000 words!
When you tell a person that you invented something, what is that person's first reaction? He/she immediately wants to see a drawing! And why? Because it is the fastest way to satisfy our natural curiosity!

You will have easily guessed the disastrous consequences in the case of the invention proposed here! It is for this reason that, from the beginning of this document, I was compelled to break the vicious circle by explaining right away the comparison stairs/cyclist-on-a-hill thus temporarily nullify the perverse effects of the optical illusion and open the reader's mind to the fact that "something" fundamental has been totally ignored by the current world of cycling.

If you do not know the comparison between someone climbing stairs and a cyclist climbing a hill while pedalling in the standing position, and that you take a look at a drawing of this invention, you will automatically be led to believe that this invention is useless since you are, without realizing it, tricked by this optical illusion!

Another strange phenomenon will occur when people will try this invention for the first time: physically, they will experience a fantastic reduction in tiredness but without understanding why, that is to say without being able to explain it by reflecting on it: people will ascertain it physically only!

It will take several years to change the "image" that people have of pedalling because this optical illusion is an antique imprinted in our mind since childhood! From a commercial point of view, the fact that people will understand physically (and not intellectually) is not important: people do not need to understand intellectually to use the invention; the only thing that counts for people is that, it is much less tiresome than using a pedal bicycle, it is safe (the foot does not easily slip as with pedals since the whole foot is supported, and the foot is not attached: practical in case of a sudden stop), and, for the ladies, no more large calves (the greatest fear of women): finally, a nice leg... People do not try to understand how such feats are possible; it works and that's all they care about...
Why is it so difficult to discover an optical illusion? People do not try to verify if what they see is true: why would they do it?

Why would we doubt of something that we are visually certain of? Most people believe in only in what they see, just like Saint Thomas! However, to discover something extraordinary, one must verify what appears evident, no matter that this "apparent evidence" is optical in nature (the case which is of interest here), is intellectual in nature (the case of Einstein who doubted of the veracity of certain assumptions in classical physics), or is spiritual in nature (... for later...)!

People revisit what they doubt and not what they are certain of; to discover something, one must do the reverse: analyse what we are certain of in case that it would be false!!!!!

An optical illusion will not tell you that it is an illusion: one must discover it by comparing what one sees with another totally independent visual phenomenon: it is the only way to succeed. And this happens very rarely.

The inventor has discovered this optical illusion of the leg by chance, thanks to an exceptional combination of circumstances!

It is like winning the lottery: it is very rare but it does happen sometimes! Cycling experts did not make mistakes, in the sense of "making an error" due to a lack of judgement: they were tricked against their will, involuntarily induced in error by this optical illusion of the leg (that we will define later) in the same way that the greatest scientists of the world, for thousands of years, have been involuntarily tricked by the optical illusion of the sun which travels across the sky, until someone discovers this illusion and (courageously) attempts to explain to these scientists that the earth rotates on itself, the sun remaining in place.

These scientists did not believe him, even with supporting proofs: they refused to believe him (by pride). Like these scientists, you will not believe the inventor with regards to the optical illusion of the leg; you will believe him very little if you just read the text without carrying out the 4 proposed experiments. In making these experiments, you will begin to believe the inventor and, by testing the prototype of the invention, you will be compelled to believe the inventor.

Here is what will be your reaction to the remainder of this document: it is definite, and I say that because it was my reaction (and I am the inventor): at first, I had difficulty with what I had discovered! I believed in it totally only after testing the prototype ...This is the dominant characteristic of a truly revolutionary invention! The more revolutionary, the least belief people have in it, even with proofs. One must force people to believe by cramming information into their heads: being an inventor is not easy!

The explanations that will follow are simplified to the maximum; the complex scientific explanations have been purposely left out so that the reader does not lose sight of the main thrust of the document.

Important: later in this document, many mechanisms are described; some mechanisms have more creative content than others, some mechanisms have advantages that other do not: the experience acquired in their use will determine which of these mechanisms will be commercialized. But these mechanisms have a common feature: they all carry out the same function, that is to avoid the contraction of the calf by providing a support to the heel (directly or indirectly).

But the importance of this document does not come from these mechanisms; THE CORNERSTONE which supports this document are the proofs (experimental and theoretical) that the contraction of the calf cannot increase the pressure on the pedal and that, consequently, it suffices to replace the pedal by a mechanism which avoid the contraction of the calf (by supporting the heels), thus permitting a very large energy saving without reducing pressure for propulsion!

The inventor has made a scientific discovery with regards to the functioning of the leg in the particular case of its utilization for applying pressure on a pedal: he has discovered that the whole world has been tricked by an optical illusion which makes one believe (falsely) "that the contraction of the calf increases the pressure on the pedal".

That is the essence of this document and not the dozen mechanisms described at the end; of course these mechanisms are important, but only insofar as they allow the effectively use the principle of this scientific discovery.

It is the proofs (experimental and theoretical) that "the contraction of the calf cannot increase the pressure on the pedal" which give a scientifically proven value to these mechanisms by proving that they cut in half the energy consumption.

Table of contents

Then the description of the mechanisms, the abstract and the claims will follow.

CHAPTER 1: additional observations concerning the comparison of STAIRS/CYCLIST ON A HILL at the beginning.

Here is a truth, which is MORE THAN EVIDENT, that will be very useful later.

In the case if Fig. 1 and 2, the pressure on the stairs is strictly equal to the WEIGHT of the person climbing the stairs, REGARDELESS of whether the person is climbing with heels ON the stairs (Fig 1) or FREE FLOATING (Fig 2); therefore, here is this evident truth:

In the case of Fig. 2 (free floating heels), the forced contraction of the calf DOES NOT INCREASE the pressure on the stairs (which is equal to the person's weight, as in Fig. 1).

One can arrive at a SIMILAR and evident truth in the case of a cyclist climbing a hill while pedalling in the standing position:

REGARDLESS of whether the heels are NOT supported (the case of the pedals) or SUPPORTED (as is the case for the invention proposed here), the pressure for propulsion is always equal to the WEIGHT of the cyclist; therefore, in the case of the pedal (Fig. 4) the forced contraction of the calf DOES NOT INCREASE the pressure on the pedal: the WHOLE pressure on the pedal comes UNIQUELY FROM THE WEIGHT of the cyclist.

The inventor wanted to mention this EVIDENT truth because, later in the document, we will prove a similar truth but which is NOT evident in the case of cycling in a SEATED position, that is to say that, in a SEATED position, the TOTALITY of the pressure on the pedal comes UNIQUELY from the contraction of the THIGH muscles: the forced contraction of the calf DOES NOT INCREASE the pressure on the pedal. The inventor simply wishes to explain that a PROFOUND SIMILARITY exists between the STANDING and SEATED positions:

> that someone pedals standing OR sitting, the forced contraction of the calf DOES NOT increase the pressure on the pedal; however, in the case of the SEATED position, THE WHOLE WORLD thinks EXACTLY THE OPPOSITE of what I just stated:
>
> the whole world is totally convinced that, in the SEATED position, the contraction of the calf INCREASES the pressure on the pedal! However, the whole world knows perfectly well, that in the STANDING position, the contraction of the calf DOES NOT INCREASE the pressure on the pedal!

HERE IS THE CONTRADICTION: the whole world knows very well that, STANDING, the pressure on the pedal comes uniquely from THE WEIGHT of the cyclist, the calf NOT CONTRIBUTING to this pressure. However, the same WHOLE WORLD is totally CONVINCED OF THE CONTRARY for the SEATED position: the whole is convinced that, in the SEATED position, the contraction of the calf contributes in increasing the pressure on the pedal while, in reality, IT IS FALSE:

we will prove that, in the SEATED position, the contraction of the calf cannot increase the pressure on the pedal; we will explain that, in the case of the seated position, this WORLD-WIDE error comes precisely from the OPTICAL ILLUSION OF THE LEG. Therefore, this illusion occurs ONLY when we look at the leg applying pressure on a pedal while in the SITTING position and NOT while STANDING.

Conclusion: the OPTICAL ILLUSION OF THE LEG, which we will define later, occurs ONLY in the SEATED position.

CHAPTER 2: the real role of the calf.

We have already demonstrated that the calf is USELESS in the case of the STANDING pedalling position, using the comparison STAIRS/CYCLIST ON A HILL that you have read earlier; we will soon PROVE that the calf is also USELESS in the SEATED position. Therefore, the CALF is COMPLETELY USELESS in cycling "with pedals" since its contraction CANNOT increase the pressure on the pedal and, in addition, the calf is HARMFUL since it consumes a great amount of useless energy (we will see later that experts greatly UNDERESTIMATE the energy consumption of the calf: the REAL energy consumption of the calf is FOUR TIMES higher than what the specialists have estimated; unbelievable but true, and we will PROVE IT).

In the PARTICULAR CASE OF PEDALS the calf is useless and harmful; but in other situations WHERE PEDALS ARE NOT USED, the calf is INDISPENSABLE: standing still, walking and running. The calf is indispensable to KEEP THE EQUILIBRIUM when we remain STANDING still: without it, WE WOULD FALL FORWARD. Indeed, when we stand still and our body is SLIGHTLY bent forward, the calf slightly contracts (and for a fraction of a second only) and pulls SLIGHTLY on the heel to STRAIGHTEN our body. This BARELY PERCEPTIBLE process goes on continuously; this is REAL ROLE OF THE CALF and this process requires VERY LITTLE energy since the heel RESTS ON THE GROUND: this is why we can remain standing still for a very long time WITHOUT EXHAUSTION.

While WALKING, the calf has TWO uses:

- as in the standing still position, the calf spends little energy to maintain equilibrium,

- for walking, the calf also exerts a slight propulsive forward force to allow us to move forward. When walking, the heel keeps off the ground for half the time (rear leg) and it is while the heel is off the ground that the calf exerts its forward propulsive force (always the rear leg); however, very important point, when the calf of the rear leg exerts a force because the heel in off the ground, 90% of the body's weight is supported by the other leg (the front leg) the heel of which is on the ground! Therefore, the contraction force of the calf required to walk forward is very weak. Indeed, we can walk many kilometres without tiring as long as the heel of the forward leg rests on the ground for every step. To convince yourself, try to walk by never placing your heels on the ground (walking on the tip of your toes continuously): you will be completely exhausted after a few hundred meters only! (situation similar to climbing 30 stories with heels on the stairs versus climbing only a few stories with the heels free floating).

- therefore, for standing still and walking, the contraction of the calf is indispensable and is useful because it has a precise function: provide equilibrium and forward motion. Therefore, the energy spent by the calf, when standing still or walking, is utilized to fulfil useful role and the amount of energy spent is small, compared to the pedals where the contraction of the calf has no useful role and requires a large quantity of energy!

While running, the work imposed on the calf is greater than while walking, but this work is useful since it allows us to gain speed; during marathons, the runner takes great care in placing the heel of the forward leg on the ground (leg which supports 90% of the weight), thus the contraction of the calf of the forward propelling leg (rear leg) is much smaller than 3 times the runner's weight (since the rear leg supports only 10% of the weight: therefore, the calf supports 30% of the runner's weight compared to 300% when we climb stairs with the heels free floating since, in the case of the stairs, the calf supports 3 times the person's weight). Therefore, while running, all the energy spent by the calf is used to fulfil a useful function: to allow us to move faster than walking and the amount of energy spent is 10 times less than when cycling in standing position (the calf having no useful role in the case of the pedal).

Therefore, when we stand still, the real role of the calf is to us from falling; while walking, the calf spends a little more energy which is well spent since we move; while running, the calf spends a little more energy than while walking, but this energy is well spent since we move faster than while walking. However, when we climb stairs with the heels free floating or while pedalling in the standing position, the calf fulfils a useless and harmful role, useless because it does not help to climb the stairs or the hill faster, and harmful because it consumes approximately half of the energy with no reason: a complete waste...

CONCLUSION: the calf is not designed to exercise considerable efforts (such as supporting 3 times the weight) and for extended periods of time, especially when this is useless! Bio-mechanically, the calf is visibly conceived to apply small efforts during short periods, as in standing still, walking and running.

We have now completed the standing position. We have used the examples of the stairs, the hill, walking and running. We can climb certain hills while pedalling in the seated position and, we could also pedal in the standing position on flat terrain to fight against a strong head wind.

A little bit of reflection will help you understand that all of what has been explained to date with respect to the standing position can be universally applied.

Now, the real surprises will surface while we begin to study pedalling in the seated position, which will allow us to explain the optical illusion of the leg. The four experiments with the weighing scale, in the seated position, will be particularly important: everything will be proven experimentally. The first two will prove the real existence of the optical illusion of the leg, and the last two will prove that this invention halves)at minimum) the energy consumption in the seated position without loss of power compared to a bicycle with pedals.

CHAPTER 3: two aspects of the invention:

- the spectacular

- the fantastic (but not very spectacular).

The spectacular aspect consists in experimenting by climbing a hill with the invention, and to climb the same hill again with a "pedal" bicycle (the next day only, to make sure one is rested, to make a valid comparison); or take 2 persons in the same physical condition, one with the INVENTION and the other with a "pedal" bicycle and get them to climb a hill at the same time: we can immediately note an enormous difference between the two! The fact that the person using the INVENTION can accelerate while climbing (such that it is readily visually perceptible) is truly spectacular: this is unique in the world and noticeable!

The fantastic (but not very spectacular) aspect is the reduction by a factor of two of the energy consumption in the seated position (on flat terrain most of the time). Why is this aspect not too spectacular? Because we do not notice the difference immediately (compared to the pedals): it takes longer to physically feel the difference with the pedals. The human energy reservoir has a limited capacity, we must maintain a low average pedal pressure if we want to cover an appreciable distance: therefore, we must cover a very long distance (which requires more time) in order to physically feel a noticeable difference. Therefore, this is not too spectacular.

Even though it is not too spectacular, halving (at minimum) the energy consumption in the seated position is fantastic!

And why is this? Because it makes this invention useful and pleasurable to the whole population, not only a few privileged groups. The whole value of this invention comes uniquely (almost) from the seated position, the contribution in energy savings on hills being comparatively negligible (although spectacular).

Here is why. The average cyclist avoids hills: most of the time is spent on flat terrain; only racers and youngsters show an interest in hills. If there were no energy savings in the seated position with this invention (therefore, only a savings in the standing position), only racers and youngsters would be interested by this invention, and not the WHOLE population; therefore, the energy savings in the seated position is of prime importance to interest the whole population (women, older people ...).

The average cyclist simply wants to go from point A to point B while spending the minimum amount of energy, either for pleasure or necessity (ex: going to work).

Older people and women will be attracted to the energy savings in the seated position: several of them refuse using a bicycle because they find the pedals exhausting even on flat terrain; women will be further attracted to this invention because it will prevent developing unsightly large calves (a catastrophe for ladies) by eliminating the forced contraction of the calves (this aspect is extremely interesting from a commercial point of view, that's evident).

Finally, older people, women, children, racers, mountain bikers ...will all be attracted by the SAFETY aspect of the invention: contrary to the pedals, the feet cannot slide off with the INVENTION; when going over holes or bumps with a pedal bicycle, our feet have a tendency to slide off causing possible loss of equilibrium; the proposed INVENTION replaces the pedals which support the whole foot, yielding a great measure of safety: the foot cannot slip off even though they are not attached; these platforms are provided with automatic foot positioning guides which always maintain the foot in the correct position; since these guides are located on only one side of the platform, it is easy to quickly move the foot to the ground in case of a quick stop and the correct repositioning of the foot on the platform is as, without the need to look, thus increasing safety.

Therefore, the increased safety, the fact that the calves will no longer get inordinately large (for women), and ESPECIALLY the reduction in energy consumption by a factor of two (minimum) in the SEATED position, are the elements which make this invention so fantastic, even though the 3 elements referred to are not very spectacular compared to the experience in climbing a hill.

The fantastic aspect comes from the fact that these 3 elements make this invention very interesting for the whole population, while the spectacular aspect (climbing hills) interests racers and youngsters only.

Note: here we have a problem with the vocabulary. Indeed, the word "pedalling" is specifically applied to the pedals themselves; if we replace the pedals by what we call platforms in this document, logically we should use a word other than "pedalling": the word "platforming" is ridiculous. For the moment, to solve this problem temporarily, we will continue using the word "platform" to designate "this thing" that replaces the pedals, and we will continue using the word "pedalling" to designate the use of the platforms.

CHAPTER 4: how the entire world (including the experts) interprets pedalling.

Today, this interpretation is exactly the same for everyone: the experts, the man of the street, the racer ... All visualize the functioning of the leg in the same fashion, in the particular case of its use with the pedal. It is that interpretation which will now be given; then we will prove that this interpretation is false and we will explain the optical illusion which has tricked everyone. To properly assimilate what follows, try and forget completely what has previously been explained, especially the comparison stairs/cyclist on a hill (its only purpose was make you understand that "something important" has been completely forgotten by the current cycling industry, without specifying what it is). Put yourself in everyone's shoes: interpret pedalling as they visually do. Therefore here is the interpretation of the world.

Fig. 5 depicts a leg which applies pressure on a pedal, in the seated position. Is this drawing normal? Yes, of course: the position of the foot on the pedal is the one recommended by the experts, the toe joints resting on the pedal axis, the heel free floating. If we ask everyone (experts, the man on the street, racers etc...) which muscles produce the pressure on the pedal, after reflection, all will answer the same thing, and will say this:

"... the pressure on the pedal comes from two sources, the first being the thigh and the second being the calf, the two forces COMBINING..."

An expert will explain further and state (see fig. 6 & 7): ..."the pressure on the pedal is made up of two forces which combine; the first comes from the contraction of the thigh muscles (mainly the gluteal and the quadriceps) which pushes the leg down producing the first pressure force (5, fig. 6) which push the thigh bone (6) downwards, thus producing the first pressure force (P1) on the pedal. The second force on the pedal (P2, fig. 7) comes from the contraction of the calf (4) which pulls the heel upwards, which has a tendency to rotate the foot around the ankle (1), thus producing a downward movement of the toe joints (2), thus resulting in a second pressure force (P2) on the pedal. The total pressure on the pedal is the sum of the pressure from the thigh (P1) and from the calf (P2)..."

Note: the muscles shown (5, fig. 6 and 4, fig. 7) are only symbolic; what is illustrated is not the real muscle structure. For example, the calf (4, fig. 7) is made up of the two twins and the soleaire (not shown); with respect to the "muscle" (5, fig. 6), it symbolizes the downward push of the thigh; in reality, the thigh's downward push is caused by two muscles: the gluteal which, by contracting, pushes directly the thigh bone downwards, and the quadriceps which extends the leg: because the foot must remain on the pedal, this leg extension produces a downward displacement of the thigh since the pedal moves down, evidently. Therefore, these two muscles (gluteal and quadriceps) produce a downward movement of the thigh, and that is what is symbolized by the muscle 5, fig. 6.

With respect to this document, we do not need to concern ourselves with the **actual** muscular structure since we are making a purely mechanical study of the leg: we are studying 3 articulated segments, the foot, the leg bone and the thigh bone, joined together with points of rotation (the heel and knee articulations), by concentrating on a **precise detail**, i.e., study the role that the **calf** plays from a purely mechanical point of view. This will all become very clear in your mind as you read this document.

CHAPTER 5: definition of the **optical illusion of the leg.**

What follows will shock you! At the beginning, you will not believe the inventor, just like the great scientists did not believe the man who wanted to explain that the sun **does not move** across the sky, that it is an **optical illusion**!

They **refused** to believe even with supporting **proof**! In our case, it will be **mostly** the experts in cycling who will **refuse** to believe. **In making** the first two proposed experiments (with the weighing scale), you will **begin** to believe and, by **trying** the prototype, you will be **compelled** to believe!

This **optical illusion** is represented by fig. 7: what we have **visualized** on fig. 7 is **not real**: in reality, the force P2 is **zero** since the **calf**, by contracting, **cannot** exercise any pressure on the pedal! The **total** pressure applied to the pedal comes **only from the thigh** (force P1 on fig. 6). And this statement, which we will **prove** shortly, is the **exact opposite** to what the **whole world** thinks!

It is how the pedal is **used** that **forces** the calf to contract since the heel is **free floating** (not supported). Because the contraction of the calf **cannot** increase the pressure on the pedal, this calf contraction is **pure energy waste**: therefore, the proposed invention **eliminates** this waste of energy by providing support to the heel, **without any loss of propulsion pressure** since the **whole pressure** comes **uniquely** from the thigh!
There is a great similarity between the **standing and seated** pedalling positions; standing, the calf contraction is 3 times the **weight** of the cyclist while, seated, the calf contraction is 3 times the **downward pressure** applied **by the thigh**: the only difference between the two positions residing in the **intensity** of the forces at play.

Put into words, the **optical illusion** which has tricked the **whole world** for at least a century is :

"... to believe that the calf contraction **pulls** the heel **upwards**, making the foot **rotate** around the ankle, causing a **downward** movement of the tip of the foot and thus **increasing the pressure on the pedal**...".

Later in this document. we will explain with precision **why** people believe (falsely) that: in brief, it is because of the way our mind functions when **visual perception** is involved!

What strongly characterizes this invention, is that the most diverse knowledge is involved, not only physical and mathematical sciences: we must also take into account **psychological** and **bio**-mechanical considerations and "human nature"; it is the **only way** to explain **how** billions of people (even scientits) have been **induced** in error for so long. At the same time, this demonstrates that inventions based on the discovery of an optical illusion are **very rare**, thus giving them a **great** value. The optical illusion will not tell you that "it **is**" an illusion! You must **discover** it! In fact, the truth **hidden** behind the illusion is perfectly protected against discovery: a "security agent" prevents intruders from opening the door, and this agent is the optical illusion itself!

The next chapter is **revealing**, since it **proves** (experimentally) the **real** existence of the optical illusion of the leg!

Later in the document, **theoretical** proofs will be given, thus definitely eliminating all doubt from your mind.

CHAPTER 6: **experimental** proof of the existence of the optical illusion of the leg and of the energy waste that follows.

We shall **prove** that the **whole world** is wrong by carrying out 4 experiments which are very simple! All we need for material is a straight chair and a simple portable weighing scale (the type that one would use to check one's own weight).

Sit down and place only **one** foot (the right for example) on the weighing scale; leave the left foot on the floor besides the weighing scale. **Do not cheat:** do not try to create leverage with your hands (e.g: by pulling on the chair armrests) and do not try to push with your body by bending forward; remain straight up on the chair and apply pressure **with one leg only**. It is important that you do not lift the other foot; it must remain on the floor (we are instinctively tempted to lift the left foot **without thinking about it**: this will falsify the results). Repeat the experiment **several times** to ensure correct results. We will carry out 2 tests (fig. 8 and 9).

Fig 8: in the first test, the heel must rest **on** the weighing scale (7), in order to **avoid** calf contraction. You will have understood the trick used: thanks to the weighing scale, we can **measure** the pressure applied by the leg! Therefore, the weighing scale replaces the prototype since the heel is supported.

Fig 9: in the second test, only the **tip of the foot** rests on the weighing scale, with the heel **free floating**, which **forces** the calf to contract, exactly as in the case of a pedal. Here, the scale plays the role of a conventional **pedal** with the advantage that we can **measure** the pressure obtained!

Thanks to these 2 simple tests, we can **measure the difference** between the ordinary pedal and the proposed invention. Please do not be content with **reading** about the experiment: **carry out** these 2 tests; this way you will be able to **physically** verify that the **optical illusion is a physical reality!** You will be surprised by the results which will **contradict** what the **whole world** thinks, nothing less!

The two tests (Fig. 8 & 9) consist in applying **full force** on the weighing scale (7) **with one leg only** and to **note the pressure obtained**. This is very important: do not try to apply the force with the leg in a jerky fashion (quick and abrupt); you must apply the force **slowly and gradually** until you slowly reach the **maximum**, and note the result. The only difference between the 2 tests is that the calf does not exercise **any** force in the first test (Fig. 8: the **invention**), and the calf exercises a **lot** of force in the second test (Fig. 9: the **pedal**). Evidently, the **thigh** exercises the **same force** in the two tests since you have applied **maximum force** in both cases.

Before you carry out the two tests, please note this: if the following is what the **whole world thinks as true**, i.e: "... the pressure on the pedal comes from **two** sources, the first being the **thigh** and the second being the **calf**, the two forces **combining**..." then, in carrying out the tests, you would normally obtain a **higher** pressure in the **second** test (Fig. 9) than in the first (Fig. 8) because **both** the thigh and the calf exert a force in the case of the second test while **only** the thigh applies pressure in the case of the first test. Since the thigh applies the **same** pressure for both tests (because we apply **maximum** pressure), then, if the whole world is right, the pressure for the second test **must** be greater than that obtained during the first test since, in the second test, the pressure from the calf **combines** with that of the thigh.

This is what **our eyes** seem to indicate. Now let's **verify** if the **whole world** is right or wrong by **doing** the 2 tests!!! The **astonishing answer** is that the whole world is **mistaken**!!! Even I, **who after all is the inventor**, had difficulty in **believing** what the graduated weighing scale was showing!

It seemed totally crazy, contrary to natural laws, contrary to what I thought was visually true! I was forced to admit that my eyes were deceiving me! I then thought of the optical illusion! But it remained that I had to understand the phenomenon and try and explain it in simple terms: it took me two complete years to complete that task. When ONE KNOWS the contents of this document, one concludes that this is all relatively simple, but to discover all this starting with nothing, it takes several miracles: it is not at all evident...

The inventor carried out the 2 tests dozens of times and he has always obtained the exact same results, namely 54 pounds of pressure in each of the two tests: the pressure obtained was exactly the same, whether the calf exerts a force (Fig. 9) or not (Fig. 8)!

There is only one possible conclusion: "The contraction of the calf in the second test (Fig. 9) does not increase the pressure on the weighing scale (the pedal)..."

This statement is exactly the opposite of what the whole world thinks (the whole world being CONVINCED that the calf contraction INCREASES the pressure on the pedal)!

Therefore, when one pedals in the seated position using a conventional bicycle, the total pressure on the pedal comes only from the contraction of the thigh muscles: the forced contraction of the calf is pure waste of energy and this waste is enormous, as the next two tests will show!

CONCLUSION: Fig. 7 represents an OPTICAL ILLUSION! Force P2 is ZERO: it does not exist, IT IS AN ILLUSION!

IMPORTANT: it is not by luck that the pressure is exactly the same for the 2 tests (54 pounds) to the nearest pound!

It proves that the total pressure comes uniquely from the thigh; if we apply maximum thigh pressure in both tests, then the intensity of the force is the same for each test (the maximum of the first test is obviously equal to the maximum of the second!). the inventor has obtained exactly 54 lbs with each of the 2 tests, but this value can evidently vary according to the physical condition of the person doing the tests; however one thing is certain: if you obtain 38 lbs in the first test, then you will get 38 lbs in the second test, if you carry out the test properly (without leveraging with your arms, adding pressure by moving your body forward, and leaving one foot on the ground).

Now we will make two more similar experiments to verify that there is indeed a division by a factor of three (approximately) of the energy consumption in the seated position, without loosing pressure for propulsion (i.e: same power with a bicycle with ordinary pedals) when using a INVENTION. You will experience physically this enormous difference! These two tests are very similar to the two preceding tests except that they must be carried out with additional care in order not to obtain erroneous results.

Take the same precautions as before: do not leverage with your arms, do not add pressure by moving your body forward, and especially, leave one foot on the ground (we instinctively lift that foot without realizing it, thus giving erroneous results). You must take this additional precaution: in the two tests, it is mandatory that the leg remains perpendicular (90 degrees) to the weighing scale (7), as shown in fig. 10 and 11. If the weighing scale tends to slide forward, place a heavy object in front to block it.

During these 2 tests you must apply pressure GRADUALLY to the maximum as in the previous two tests, but the objective is to MAINTAIN the maximum pressure AS LONG AS POSSIBLE, note your LEVEL OF FATIGUE when your heel rests on the weighing scale compared to your level of fatigue when your heel is free floating. You must maintain the maximum pressure constant during the whole test: if for example you have obtained 38 lbs in the 2 preceding tests, you must maintain this level during the test, making sure that the pressure level does not go lower than of 38 lbs. Repeat these tests several times to confirm the results.

These 2 tests of energy consumption (as measured BY THE FATIGUE LEVEL) should give you results similar to this:

First test (heel on the weighing scale, fig. 10): here, the calf does not consume energy since it does not contract. It is the equivalent of the INVENTION.

Results obtained by the inventor:

a) he has maintained a maximum pressure of 54 lbs during 90 seconds,
b) after approximately 45 seconds into the test, he begins to feel a slight muscle pain to the thigh,
c) 90 seconds into the test, this muscle pain begins to be unbearable,

d) the inventor stops the test, but he notes that his cardiac rhythm has not increased appreciably and that he is not out of breath; only the thigh muscle pain has led him to stop the test, and not the fatigue caused by the energy consumption: without this pain, the inventor could have maintained the maximum pressure of 54 lbs for more than 90 seconds...

Second test (heel free-floating, fig. 11): here, the calf must contract with an intensity of more than 3 times the 54 lbs pressure, or 162 lbs: the calf consumes a lot of energy. This test is the equivalent of the USUAL PEDAL.

Results obtained by the inventor:

a) within the first few seconds of the test, the inventor realizes that it is very difficult to reach the maximum pressure of 54 lbs (however, this was easily achievable during the first test),
b) at the end of 30 seconds after having reached and maintained this 54 lbs of pressure, the inventor notices an extreme tightness of the calf; he begins to feel pain at the Achilles tendon (which attaches the calf to the heel),
c) after 45 seconds after having reached and maintained this 54 lbs, a pain in the thigh is added to that of the Achilles tendon; the inventor realizes that his cardiac rhythm is beginning to increase appreciably and that his breathing is getting faster, the whole leg is starting to shake,
d) after 60 seconds after having reached and maintained this 54 lbs, the inventor is completely incapable to maintain the maximum pressure of 54 lbs: THE PRESSURE DIMINISHES RAPIDLY....

The comparison between the results of these 2 tests leads us to state, without the risk of error, that the consumption of energy is 3 times higher (approximately) in the second test than in the first test, the second test being equivalent to using the pedal while the first being equivalent to the INVENTION! Therefore, when we use the INVENTION in the SEATED position, there is a division by a factor of 2 (approximately) of the energy consumption as compared to the bicycle, without the loss of power (since the pressure obtained is the same in the 2 tests, i.e: 54 lbs)!

The happy days of the pedal are gone! This INVENTION makes the current pedal useless, in the same way that the pedal rendered the draisienne useless 150 years ago: each his turn....That is PROGRESS!

This completes the experimental proof; later in the document, the theoretical proofs will be given. However we must first explain how this optical illusion of the leg takes hold in your mind: INTERESTING!!!

CHAPTER 7: how the optical illusion takes hold in our mind...

What are the factors which cause this illusion? Why is this illusion so powerful? Indeed, for 150 years, billions of people have been tricked, including the greatest scientists.

Concentrate on Fig 12: What do you see? You will reply that you see one box: you see only one box but there are 2!

You saw:

a) either the top box (8), the bottom of which you see (top part of fig. 13)
b) or the bottom box (9), the top of which you see (bottom part of fig. 13)

It is impossible to see both boxes at the same time! This is caused by the fact that our mind has limited power! If a computer would analyze Fig 12, it would immediately respond that there are 2 boxes, a feat our human mind could not accomplish! Our mind treats both boxes as if they were totally independent of each other; however these boxes depend on one another since the hatched portion (10) in Fig 12 is, at the same time, the bottom of the top box (8) and the top of the bottom box (9). It is this dependency between the 2 boxes which prohibits our mind to see both of them at the same time, the hatching (10) belonging to both boxes. If there were two hatched portions (10) as in the two separate boxes of fig. 13, it is evident that we could see both boxes at the same time.
What is the connection with the optical illusion of the leg? It is DIRECT and REVEALING!

Fig 14 represents the leg of a cyclist while pedalling in the seated position. Let's make an analogy with Fig 12:

- let's say that the thigh plays the rôle of the top box (8),
- that the part of the leg with the calf plays the role of the bottom box (9),
- and that the knee plays the rôle of the hatched portion (10).

Let's now go back to the interpretation that the whole world gives about pedalling (chapter 4):

"... the pressure on the pedal comes from two sources, the first being the thigh and the second the calf, the two forces combining..."

When one asks people (even the experts) to identify which muscles apply the pressure on the pedal, what do they do? They look at Fig 14, and automatically the people's mind operate exactly like the case of the two boxes of Fig 12: they begin by trying to first analyze the operation of the thigh and then the calf (or vice versa), but not the operation of the thigh and the calf together, since our mind is incapable to do it, as it is incapable to see the two boxes of Fig. 12 at the same time!

Therefore, our mind analyzes separately the functioning of the thigh and then the calf and adds the two results as if these results of the analysis independent of one another! This is absolutely analogous to the fact that we cannot see at the same time the two boxes (Fig 12) due to the existence of the hatched portion (10) which is common to them (and joins the two boxes). The same goes for the knee which joins the thigh and the calf, being a common part.

The knee plays a role which is analogous to the hatched portion (10) joining the two boxes (Fig. 12).

Here is an extraordinary revelation:

The knee prevents us from analyzing at the same time the thigh and the calf, as the hatched portion (10) prevents us from seeing the two boxes (Fig. 12) at the same time.

Evidently, this is only a simple analogy: in the case of the two boxes it is a question of visual perception, while in the case of the leg it is a question of the way one analyses its functioning. But the analogy is valid because the result is the same: in the two cases, we cannot see (analyse) the two boxes (the thigh and the calf) at the same time since the two component parts have a common part, the hatched portion (the knee), which joins them.

This is all very subtle. Later we will prove this scientifically: the very existence of the knee is the source of this optical illusion! For now, we will satisfy ourselves in stating something very profound, which merits our meditation (when you have fully understood this document):

The knee, which attaches the thigh and the calf, forces us to analyze the thigh and the calf independently, as if the thigh and the calf were not attached!

The knee therefore performs two contradictory functions:

a) it physically joins the thigh and the leg (calf)
b) it forces us to mentally separate the thigh and the calf as if they were not joined, in order to analyze as explained above!

The knee, which joins these two parts, forces us to analyze them as if they were not joined: Very strange...

To be more precise, we can state that the knee fills only the role of a physical joint: the other role is imaginary and is artificially created by our human mind which has limited power! It is not the knee that is strange but rather the human mind! Therefore, our mind analyzes the thigh and the calf SEPARATELY, and ADDS the two results, thus giving this interpretation which the whole world has about pedalling, that is:

> "... the pressure on the pedal comes from two sources, the first being the thigh and the second the calf, the two forces combining..."

This world-wide interpretation assumes that the knee does not exist (in the sense that it has no influence on the pressure applied to the pedal). This interpretation affirms that "the whole is the sum of its parts": this is true only of parts which are totally independent, but false when there is a common part. See Fig. 15 and 16.

Fig. 15: The area of circle C is the sum of the areas of circles A and B, since the circles do not have a common part;

Fig. 16: The area of circle C' is smaller than the sum of the areas of circles A and B (C'<C): the whole is not equal to the sum of the parts...

THE WHOLE EQUALS THE SUM OF THE PARTS only on Fig. 15 and not on Fig. 16. The next page is REVEALING...

The interpretation of the whole world presupposes that "the whole is the sum of the parts", that is to say that the total pressure applied on the pedal is the sum of the pressure coming from the thigh and the pressure from the calf (as in Fig. 15, by analogy): this interpretation presupposes that there is no common part, that the knee does not exist! Since the knee does exist, this world-wide interpretation is false!

CONCLUSION:

The total pressure on the pedal is NOT equal to the sum of the pressure applied by the thigh and the calf...

Therefore, to make a correct analysis of the operation of the leg, one must absolutely take into account the articulation of the knee, which is the part common to the thigh and the calf (which joins them).

A correct analysis will give us a result that will confirm that "the whole is NOT equal to the sum of its parts". Evidently, a correct analysis of the functioning of the leg must study the whole lower member as a single piece (foot, leg and thigh joined by the articulations of the ankle and the knee); such analysis must not be made visually: it must be theoretical and scientific, and that is what we'll do in the next chapter (which is divided into 8 segments).

Note: with regards to the false world-wide interpretation, the person making the analysis of the leg does not realize that he/she (mentally) cuts the lower member in two distinct parts (the thigh and the calf) by some sort of "intellectual surgery"! This person believes that the knee is taken into account while, in reality, he/she ignores the knee instead!

CHAPTER 8: theoretical analysis of the functioning of the leg, in the particular case of the pedal (This chapter is divided into 8 sections)

SECTION 1: identification of the FIRST ERROR in the world-wide interpretation (chapter 4)

This interpretation has two errors. In this section, we will discuss the first one, the second one being the subject of section 2. Let's revisit the world-wide interpretation (chapter 4):

> "... the pressure on the pedal comes from two sources, the first being the thigh and the second the calf, the two forces combining..."

This world-wide interpretation is therefore the sum of pressure P1 (Fig 6) and P2 (Fig 7. For pressure P2 (Fig 7) to exist, the ankle (1) would have to be maintained in place, and remain steady: the ankle must be a point of support. Only the leg bone (11) can maintain the ankle (1) in place and, to achieve this, there is only one possibility: a pressure in a downward direction must be applied along the leg bone (11) and this pressure can only be applied by the thigh (the knee being used as an intermediary for the transfer of this pressure).

Therefore, Fig 7 necessarily supposes that the pressure from the thigh (therefore pressure P1 of Fig 6) is used to make the ankle (1) into a point of support: this is mandatory for pressure P2 to exist. The problem is this: at the same time, Fig 6 supposes that the pressure P1 from the thigh is used to apply a force to the pedal.

Therefore, the world-wide interpretation gives TWO different uses to pressure from the thigh since Fig 6 shows that P1 is used to push on the pedal and Fig 7 implies that P1 is used to make the ankle into a point of support! The double role is evident. However, there is a fundamental principle in physics that a given force can be used for a single purpose.

The first error in the world-wide interpretation is to assign two uses to pressure P1 coming from the thigh. There are two possible scenarios, and only one of these two scenarios is true, the other forcibly being false. And we will realize the following strange thing: the scenario which appears visually false is the one which is true, while the scenario which appears true visually is the one that is false (in other words, the world upside down)!

Here are the two possible scenarios:

SCENARIO #1:

P1 from the thigh is used to make the ankle into a point of support as supposed in Fig 7. In this case, as P1 cannot have more than one use, P1 cannot be used at the same time to apply a force on the pedal as indicated in Fig 6. Therefore, this first scenario implies that P2 exists (that Fig 7 represents the reality) and that Fig 6 is false. This scenario #1 implies that the whole of the pressure on the pedal comes only from the contraction of the calf, the contribution from the thigh being NIL.

SCENARIO #2:

Pressure P1 from the thigh is used to apply a force on the pedal as indicated in Fig 6. In this case, since P1 can have only one use, P1 cannot be used at the same time to make the ankle into a point of support as supposed in Fig 7. Therefore, this second scenario implies that P2 does not exist (that Fig 7 is false) and that Fig 6 is true. This scenario #2 implies that the whole pressure applied to the pedal comes only from the contraction of the thigh, the contribution from the calf being NIL.

Therefore,
Scenario #1: if Fig 7 is true, then Fig 6 is false.
Scenario #2: if Fig 6 is true, then Fig 7 is false.
Only one of these scenarios is true, but which one is it?

Let's summarize the intellectual exercise that we have just made to ensure that all is very clear in your mind.

The world-wide interpretation supposes that Fig 6 and 7 are both true and that Fig 6 and 7 add each other.

We just demonstrated the FIRST ERROR on this interpretation, which consists in assigning TWO uses to the pressure from the thigh. Therefore, if we make a correction to this world-wide interpretation to eliminate this first error (by assigning only one use to the thigh), we obtain the two scenarios that we just defined and only one of these scenarios is true.

Visually, Fig 7 seems to be true: it is the optical illusion that we have talked about all along. If Fig 7 is true, then scenario #1 is true. However, the first two tests with the weighing scale have proven experimentally that scenario #2 is true. Therefore, there is a contradiction:

Scenario #1 seems visually true

Scenario #2 is experimentally true

However, only one scenario can be true, and it is #2 since we have proven it experimentally. Therefore, scenario #1 is false although it seems visually true: this is the mystery of the optical illusion which has NOT been yet clarified; this mystery will be resolved in the next section which will explain the second error of the world-wide interpretation.

Scenario #1 (the false scenario) not only seems visually true, but unfortunately appears to be correct IN THEORY as we shall now demonstrate!

Let's follow these steps:

- carry out the theoretical demonstration of scenario #1; this demonstration will not be correct, although it will appear to be correct; in effect, this demonstration will include the second error: try to discover the nature of this second error (...not so easy!). This SECOND ERROR is the master key to this whole document...

- we will explain this second error in section 2; this will allow the theoretical proof that scenario #1 is false, although it seems to be visually true (in addition to appearing theoretically true when we ignore the second error!).

- finally, we will demonstrate that scenario #2 is true in theory, using two different methods to remove any doubts in your mind. We already have demonstrated experimentally that scenario #2 is the true scenario, thanks to the first two tests made with the weighing scale, in the seated position.

Here, we will simplify the maximum by schematically representing the thigh, the leg, the foot and the pedal. In all examples given (for all the document) we will suppose that the thigh applies a constant downward force of 20 lbs: that's the starting hypothesis. On purpose, we will always use a crank position such that the thigh and the leg are perpendicular to each other, this particular position being the one that simplifies the demonstrations the most. The objective is to simplify things as much as possible since we wish to explain basic principles. Any scientist will easily understand that what is true for a 90 degree angle is also true for all other crank positions (there is no point in demonstrating something that is obvious to a scientist).

Theoretical demonstration of scenario # 1:

In addition to seem visually true, this scenario also appears to be true in theory! The demonstration that follows will include the second error that you should try and discover by yourself (good luck!); we will explain the nature of this second error in section 2 only.

For this demonstration, we will use Fig. 17, 18, 19 and 20 only.

This scenario #1 seems visually true. Indeed, when you look at Fig 17, what do you visualize? You begin by visualizing the thigh (5) which applies a force pushing the leg bone(6) downwards; thanks to the knee joint (13), you visualize that this force (C=20 lbs) is transmitted downward along the leg bone (11) ending up on the ankle (1) to make it a point of support by keeping it in place; this point of support (1) allows the calf (4), as it contracts, to pull the heel (12), which tends to rotate the foot around the ankle (1) and thus pushes the toe joints (2) downwards, finally creating pressure on the pedal (P).

This is what the whole world visualizes, and it appears to be true!

Let's suppose that this is true, and calculate the pressure applied to the pedal by the contraction of the calf.

Fig 18 is a schematic representation of Fig 17: the bones are shown as straight lines and the muscles are not indicated. Fig 19 and 20 are the results of our visualization discussed above.

Fig 19 isolates the leg and Fig 20 isolates the foot.

- the traction force of the calf on the heel is designated by M,

- the pressure applied by the toe joints (2) on the pedal is designated as P (Fig 17). The reaction to force P is P', which is pressure of the pedal on the toe joints; P is therefore acting downwards and P' upwards.

- we have A/B=3 (no units of measurement are used since only the ratio A/B concerns us).

- on Fig 18 and 19, force C of 20 lbs is the pressure applied (dwonwards) by the thigh bone (6) to the knee joint (13); on Fig 20, the force F=20 lbs is the pressure of 20 lbs applied by the leg bone(11) to the ankle (1); on Fig 19, the upward force F' of 20 lbs is the reaction of force F, that is the pressure applied by the ankle to the leg bone (11). On Fig 18, the forces F and F' are not shown since they cancel each other.

Now, going back to Fig 20: there must be an equilibrium of translation and rotation with respect to the ankle (1):

TRANSLATION: $M + P' = F = 20$ lbs

ROTATION: $M \cdot B = P' \cdot A$; since $B = 1$ and $A = 3$, we obtain $M = 15$ lbs and $P' = 5$ lbs.

Let's verify again these results, but with respect to the other two reference points: a) the heel and b) the pedal axis.

a) with respect to the heel:

TRANSLATION: $M + P' = F = 20$ lbs

ROTATION: $P' \cdot (A + B) = F \cdot B$; since $B = 1$ and $A = 3$, we obtain $M = 15$ lbs and $P' = 5$ lbs as above.

b) with respect to the pedal axis:

TRANSLATION: $M + P' = F = 20$ lbs

ROTATION: $M . (A + B) = F . A$, since $B = 1$ and $A = 3$, we obtain $M = 15$ lbs and $P' = 5$ lbs as in the two previous examples.

Therefore, in addition to appearing true visually, scenario #1 seems also true in theory, as we have just demonstrated!

Therefore, THERE MUST BE AN ERROR SOMEWHERE since we have experimentally proven that scenario #1 is false (using the first two experiments with the weighing scale)! This error is the SECOND ERROR within the world-wide interpretation.

In summary: the world-wide interpretation is

> "... the pressure on the pedal comes from two sources, the first being the thigh and the second the calf, the two forces combining..."

In this world-wide interpretation, there are 2 errors:

- the first error is to assign two uses to the downward force applied by the thigh, in other words pretend that this force, at the same time, is used to

  1) to push on the pedal AND
  2) to make the ankle into a point of support (thus allowing the calf to also apply a force on the pedal). We have explained that a double usage is impossible, since a given force can have only one use.

- the second error is explained in the following section.

SECTION 2: identification of the SECOND ERROR in the world-wide interpretation.

EXPLANATION OF THE MYSTERY WHICH HAS KEPT CYCLING IN SLAVERY FOR 150 YEARS!

Fig 21 is a retake of Fig 18 with numerical values of P=5 lbs and M=15 lbs as calculated in section 1; evidently, the second error is present.

Fig 22 is Fig 21 corrected to take into account the second error and thus represent the reality!

Here is the SECOND ERROR contained in Fig 21: a force has been totally forgotten, that is downward force M' coming from the knee (this force is shown in Fig 22)!

A muscle like the calf is attached at TWO extremities:

1) there is the lower point of attachment which ties the calf to heel bone via the Achilles tendon: the calf, by contracting, pulls the heel upwards (that's force M).
2) there is the upper point of attachment which ties the calf to the knee: the calf, by contracting, pulls the knee downwards (that's the forgotten force M').

FUNDAMENTAL QUESTION AMONGST ALL:

In our 3 preceding calculations (section 1), why have we completely forgotten the UPPER point of attachment of the calf (downward force M')?

Note that no one on this earth has taken this force M' into account! Indeed, if someone had already discovered this second error, the pedal would have been abandoned a long time ago and replaced by the invention proposed here: there would no longer be any bicycles with pedals on the roads! As there are only bicycles with pedals on the roads, we must conclude that no one has discovered this second error...Unbelievable but true! This gives an idea of the power of the optical illusion that this document explains!

WHY then has this force M' been COMPLETELY FORGOTTEN?

It is not logical! Indeed, if, in our previous 3 calculations we took into account the traction of the calf on the heel, then it would be completely logical to also take into account the traction of the calf on the knee (since the calf is attached at the two extremities)! Then Why have we not done it?

The answer to this simple question is THE BACKBONE of this document... Engrave the following answer in golden letters:

When we look at a leg applying pressure on a pedal, we have the tendency to visualize only the forces which tend to create movement, a displacement which is visually perceptible. If a given force creates a displacement which is not visually apparent, our mind ignores this force and that is the case of the downward force M' which originates from the KNEE (Fig. 22): the force M' does not create any VISUALLY perceptible MOVEMENT and OUR EYES IGNORE IT TOTALLY...

When you look at Fig 17, you visually perceive that the contraction of the thigh (5) tends to move the thigh bone (6) downwards: then you visually perceive the contraction of the thigh. You visually perceive the traction of the calf on the heel because it tends to displace the heel upwardly (again some movement). Furthermore, we visually perceive the pressure of the tip of the foot on the pedal for 2 reasons:

a) the traction of the calf on the heel makes the foot rotate around the ankle (1), and has a tendency to move the toe joints (2) downwards;

b) the pressure of the toe joints (2) on the pedal pushes the pedal downwards, thus propelling the bicycle forward.

The expressions "pushes", "rotates" that we have just amply used are synonymous with movement" our eyes perceive only the forces which tend to create a movement!

HERE IS THE ANSWER TO OUR FUNDAMENTAL QUESTION:

The traction of the upper calf (M' Fig 22) on the knee does not create any visually perceptible movement; we do not visually perceive this force M':

OUR EYES TOTALLY IGNORE IT!

Here is the mystery of cycling, more than 150 years old:

(Fig 22): forces M & M' cancel each other, force C (=20 lbs) from the thigh thus has a line of action directly aimed at the pedal axis. Therefore, the totality of the pressure on the pedal comes uniquely from the thigh, the contraction of the calf producing no additional pressure on the pedal.

Here is now a clear explanation of the optical illusion:

If our eyes do not perceive force M', then we falsely believe that force M (which we visually perceive) allows us to increase the pressure on the pedal by rotating the foot around the ankle: this is the mystery of the optical illusion, caused by the second world-wide error, this second error is not being able to see force M'; this second error makes us believe (falsely) that force C (=20 lbs) from the thigh has a line of action directly along the leg bone, making the ankle (1) a point of support allowing the contraction of the calf! If we add THE FIRST ERROR to this (erroneous) reasoning (which is to assign double usage to force C), we get exactly the interpretation that the world has of pedalling, interpretation which is false and is as follows:

"...the downward pressure from the thigh (C=20 lbs) has two uses:

1) create a pressure of 20 lbs on the pedal, AND

2) make the ankle into a point of support, thus allowing the calf to apply additional pressure on the pedal by rotating the foot around the ankle, the total pressure on the pedal being equal to the sum of the pressure from the thigh AND that from the calf..."

This is evidently false, as we have clearly demonstrated. The mystery is resolved!

Here, we will attempt to visually convince you that the totality of the pressure on the pedal comes uniquely from the thigh, the calf not contributing!

Evidently, we will suppose that the second error is corrected, i.e. we will say that you visually perceive the existence of force M' (Fig 22) pulling downwards on the knee (force coming from the contraction of the calf).

For a high level scientist, what follows will seem elementary to the point of stupidity! However, do not forget this: these elementary elements have been completely forgotten by the whole world! Could they have been ignored simply because they are so simple, so elementary? Scientists have often the tendency to look for answers to their questions in complex context, by assuming that there is nothing to discover by analyzing elementary elements: in general this is true, however, this is not the case when an elementary truth is hidden by an optical illusion !

Fig 23, 24, 25 and 26 show an « evolution » of the leg by schematics. Fig 23: the thigh bone is symbolized by the rigid horizontal piece (6) which can rotate thanks to a pivot (17) which symbolizes the hip joint; the rigid triangular piece (14) plays the role of the leg, the small triangle (15) symbolizes the pedal axis. When the thigh muscles (5) contract, the thigh bone (6) is pushed downward, thus creating the pressure on the pedal (15). It is visually evident that the downward force exhibited by the thigh (C=P') has a line of action oriented directly on the pedal axis, forces C (the downward force) and P'(the upward pressure of the pedal onto part 14) having the same line of action (C=P').

Let's "evolve" Fig. 23 in order that it looks more like a real leg: Let's cut the triangular rigid piece (14) to make a rigid piece in the form of an L (16, Fig. 24): this L piece does not have an ankle, it is a single piece. In this case, it is still visually evident that the downward force from the thigh (C) has a line of action oriented directly on the pedal axis (15), C and P' having the same line of action (C=P'). Note that, in the case of Fig. 24, there is no material between the pedal (15) and the knee (13), since we have cut out that part by cutting the triangle part (14, Fig 23). On Fig 24 the line of action of forces C and P' are in space.

IMPORTANT: for an instant, put yourself in the shoes of the man on the street (not a scientist); for him, in the case of Fig. 24, the downward pressure from the thigh (C) would be oriented along the vertical part of the L shaped piece (16), which symbolizes the leg bone, because for the man on the street, a force can only be propagated in a material object! His eyes do not realize that a force can be propagated in space, at the condition that the points of its application are part of a material object, the knee joint (13) and the pedal axis (15) being the material points of application of forces C and P'. By continuing the evolution the leg in this manner, we are witnessing the gradual birth of the optical illusion that we have discussed since the beginning!

Let's continue to "evolve" our leg by replacing the rigid L-shaped piece (16) of Fig. 24 by an assembly of equivalent pieces as shown in Fig. 25, i.e. parts 18,19 and 20.

The rigid parts (19 and 20) are tied together by an articulating joint (1) which symbolizes the ankle, part (20) symbolizing the foot and part (19) symbolizing the leg bone; a rope (non-stretching) (18) plays the role of the calf, one end of this rope being attached to the heel (as is the calf by the Achilles tendon), the other end being attached to the knee (as is the calf).

This assembly of 3 parts (18, 19 and 20) is therefore absolutely rigid when the thight muscles (5) push the thigh bone (6) downwards, thanks to the rope (18) being non-stretching. Therefore the role played by this assembly of parts (18, 19 and 20) is absolutely analogous to the role played by the rigid L-Shaped part (16) of Fig 24.

Therefore, for a scientist, it is evident (as in the case of Fig 24) that the line of action of forces C and P' is oriented directly on the pedal axis going through the knee articulation (13), as shown in Fig 25. He also knows that the rope (18) supports a tension equal to three times (approximately) the magnitude of force P' (=C) because of the existence of the articulated joint (1) which plays the role of the ankle. But what will the man on the street think (not a scientist)?

He will be even more convinced that the downward pressure from the thigh (C) has a line of action oriented directly downward along the leg bone (symbolized by part 19) as is the case in Fig 21, because, for the man on the street:

- a force must be propagated in a material object,

- he is visually tricked by the presence of the ankle (1), his eyes make him believe that the force is used to make the ankle (1) into a point of support, his eyes mix the notions of "point of support" and "compression force" of the ankle.

- however, the man on the street knows that the rope (18) cannot increase the pressure on the pedal since that rope cannot apply a force of contraction, a rope cannot shorten itself like a muscle which contracts.

Let's go to the final stage of "evolution" of our "leg": let's replace the rope (18) by a muscle, the calf (4, Fig 26). For a scientist, it should be evident (because of the many proofs given before in this document) that, in the case of Fig. 26, force C still has a line of action oriented directly on the pedal axis (15), as in the case of Fig. 25, 24 and 23, but with an important difference:

the calf (4) plays the exact same role as the rope (18, Fig 25), i.e. it supports a tension equal to approximately 3 times force P' (=C). On Fig 25, the rope (18) is used to maintain the length (K) in order to maintain the 90 degree angle between the foot and the leg: the rope must not be elongated as would an elastic band, in order to make possible the application of pressure C on the pedal axis, this rope making rigid the structure of the assembly of parts 19 and 20, such that to obtain the same result as that of Fig 24 (or 23).

The same goes for the calf (4) in Fig 26: the calf must maintain length (K) and for this, the human body must spend energy to simply avoid the calf becoming elongated (or stretched like an elastic band) in order to maintain this 90 degree angle between the foot and the leg.

This is important: as we have already proven before in this document, the contraction of the calf cannot increase the pressure on the pedal; the calf must spend energy solely because the heel is not supported, is free floating: if additional energy is spent to shorten the calf a little during pedalling, it is uniquely a question of comfort, just a matter of reducing a little the numbness in the calf, but this extra comfort is achieved at the expense of additional energy being wasted as far as the increased pressure on the pedal is concerned. A muscle is not a rope; a muscle must consume energy simply to maintain its length.

At this final "evolution" stage of our "leg" (Fig 26), the man on the street is absolutely convinced that force (C) from the thigh has a downward line of action oriented along the leg bone making the ankle a point of support, making him believe (falsely) that, thanks to this point of support, by contracting the calf can pull the heel upwards, thus rotating the foot bone around the ankle, thus increasing the pressure on the pedal (wqe already have demonstrated that this is impossible)!

This is the optical illusion of the calf. As we have just explained, the truth is that this line of action of C is oriented directly on the pedal and that the calf spends only the energy required to maintain length K (Fig 26) in order to maintain the 90 degree angle (approximately, depending on the comfort desired) between the foot and the leg, in order to simply make pedalling possible!

We will now explain that the calf cannot spend additional energy to shorten itself (having a length shorter than K) independently of the intensity of the force C (of the thigh) since, in this case, the thigh would rise, the rotation and translation equilibrium no longer being maintained.

What follows is fundamental; we will anticipate somewhat the content of the next section 3, where we will demonstrate the following 2 equations (see Fig 22):

1- C=P', i.e. the pressure on the pedal (P') is always equal to the downward force from the thigh (C) (the whole pressure on the pedal coming solely from the thigh, the calf not being able to contribute);

2- M=3.P, i.e. the calf contraction is 3 times the intensity of P', the ratio of distances A/B being 3; here, the calf is only supporting a tension, this tension being determined by the intensity of P' (and not the other way around).

Therefore, events happen in this order: the thigh (C) contraction determines the intensity of P', and then the calf (M) contraction is determined by the intensity of P' (3 times P'). This is the only possible sequence of events. Evidently, the whole world falsely gives another sequence of events, that is the thigh contraction (C) and the calf contraction (M) add to each other to determine the intensity of the pressure on the pedal (P')!

By combining these 2 equations (by eliminating P'), we get M = 3C; by rewriting this equation in terms of increments, i.e. M = 3. (C), it becomes evident that it is impossible for the calf to act alone (independently of the value of C); in other words, if for example C=20 lbs at any given moment, then M must be 60 lbs:

> if you attempt to increase the value of M to 63 lbs (therefore M=3 lbs) without increasing the value of C to 21 lbs (therefore keeping C at 20 lbs, not 21 lbs), it is your thigh which would rise as soon as you would attempt to go beyond the value of 60 lbs for M: it is impossible to increase the value of M beyond 60 lbs if you do not increase the value of C by a third of the increase of M (C= M/3)!

From this we infer the universal law of pedalling which will be demonstrated experimentally in section 4:

> "Each increase of the calf contraction (M) must (in order to be possible) be simultaneously accompanied by an increase of the contraction force of the thigh (C) equal to one third of M. If C=0 (if we do not increase the value of C), then, in this case, it is impossible to increase the contraction force of the calf (M=0) in order to increase the pressure on the pedal since, in this case, there would be no longer any equilibrium of rotation as we will see in the following section 3. Therefore, the whole of the pressure on the pedal can only come from the thigh, the calf not being able to contribute. If we increase the value of C to 21 lbs (C=1 lb), in this case then, M=3 lbs, but the increase of the pressure on the pedal (P') comes only from C (since C= P'), therefore from the thigh and not from the calf."

This universal law of pedalling is simply scenario #2 (the true one) put into scientific words...

SECTION 3: theoretical proof that scenario #2 is true.

Fig 27 recaptures Fig. 22 (which illustrates scenario #2). Evidently, this scenario states that the totality of the pressure on the pedal comes uniquely from the contraction of the thigh and that the calf cannot contribute to this pressure. There must be an equilibrium of translation and rotation. Fig 27: in the case of translation, there is equilibrium without a doubt, indeed C=P' and M=M' in intensity, and the line of action is the same in the two cases.

There is only the equilibrium of rotation to verify. We can choose any point of reference but, in choosing the ankle (1), the equations are simplified to the maximum (the reader could make his/her own verification of the equilibrium of rotation with respect to any other points of reference).

Therefore, with respect to the ankle (1), we must have:

left rotation = right rotation.

$(C.\sin\alpha).L + (M.\cos\beta).B=(M'.\sin\beta).L + (P'.\cos\alpha).A$ - EQ-1,

As M=M' and P'=C, equation EQ-1 becomes, by rearranging terms:

$C.(L.\sin\alpha - A.\cos\alpha) = M.(L.\sin\beta - B.\cos\beta)$ - EQ-2

However, $A/L = \tan\alpha = \sin\alpha / \cos\alpha$, therefore, $L.\sin\alpha - A.\cos\alpha = 0$, which is the left part of EQ-2 above.

Also $B/L = \tan\beta = \sin\beta / \cos\beta$, therefore, $L.\sin\beta - B.\cos\beta = 0$, which is the right part of above EQ-2.

Therefore, we get (equation EQ-2) C.0=M.0 or 0=0.

There is therefore an equilibrium in rotation, scenario #2 is true.

From Fig 27, we isolate the leg bone (Fig 28) and the foot (Fig 29).

Force F (Fig 29) is the compression force on the ankle (1); force F' (Fig 28) is the reaction of force F (which is the action); indeed, F is the push of the leg bone onto the ankle, and F' is the push of the ankle onto the leg bone (forces F & F' are not shown on Fig 27 since they cancel each other).

Fig 28: C.cos + M'.cos = F' (translation) EQ-3

Fig 29: F.A = (M.cos).(A+B) (rotation around point X) Eq-4

Here, something biological is involved, muscles: therefore, we will suppose something reasonable, i.e. cos = cos =1 (in reality, the precision of the calculations is evidently not the goal here: we only wish to explain general principles).

EQ-3 becomes: C + M' = F' and EQ-4 becomes F=4.M/3 (since A=3.B);

eliminating F (or F') form EQ-3 and EQ-4 (since F=F') we obtain

C + M' = 4.M/3; as M=M', we finally get

M = 3.C

This equation is identical to the one obtained at the end of the preceding section (section 2); please read again the end of section 2. According to this final equation (M=3.C), the calf cannot contract by itself, independently of the contraction force (C). The calf can only support the tension (equal to 3.C) which is imposed by the contraction of the thigh; the calf plays a role absolutely identical to that of the rope of Fig 25, except that the human body must spend energy in order that the calf, by contracting, can maintain length K (Fig 26), to avoid being stretched like an elastic band (to maintain the angle between the foot and the leg at the desired value). But the force of the calf contraction (M) can be increased only if the force of contraction of the thigh (C) is also increased at the same time by a third of that value (C=M/3): in this case, the increase of the pressure on the pedal (P') comes only from the increase of the thigh contraction since, P'=C, we also have P'= C.

Therefore the calf cannot contribute to the pressure on the pedal:

An increase in the force of contraction of the calf (M) is always caused by an increase of the contraction of the thigh (C), and it is this C which causes an increase of the pressure on the pedal: it is not M which causes an increase in pressure on the pedal...

CONCLUSION: scenario #2 is the true scenario. The totality of the pressure applied to the pedal comes solely from the contraction of the thigh, the calf not contributing to it: the calf only supports a tension equal to three times the pressure on the pedal simply to make pedalling possible (to maintain the angle between the foot and the leg at the desired value). What a waste of energy, caused by the simple fact that, with a pedal, the heel is free-floating, these pedals still being used because of the optical illusion that "the calf increases the pressure on the pedal by pulling the heel upwards...".

SECTION 4: experimental proof of the universal law of pedalling.

This law is essentially scenario #2, the true scenario. Here we will deduce this law by theoretically reflecting in terms of increases or mathematical variations (that we will call x); from a very simple experiment, we will make our theoretical deductions by assuming (in our mind) that the weight of the leg is NIL (=0).

Some will pretend that, at the start, the experiment is skewed since the weight of the leg is not nil. Here I retort that this is not important since, as we pedal with two legs, the weights of legs cancel each other (a situation analogous to two children of the same weight swinging on a wood plank supported at its center - the swing of our childhood).

In the following experiment, we forget about the weight of the leg simply because our reasoning involves only one leg, and not both legs simultaneously.

Experiment: sit down on a bicycle with pedals and put on the brakes to prevent the bicycle from moving. Keep the left foot on the ground and place your right foot on the pedal which is the upright position, your thigh being in the horizontal position (evidently, the toe joints must be on the pedal axis); put out of your mind the weight of your right leg, just imagine that its weight is nil.

Since we assume that the weight of the leg is NIL, therefore there is no pressure on the pedal and the contraction of the calf is ZERO. Now, try to apply real pressure on the pedal by contracting the calf only, i.e. you do not apply pressure with the thigh (C = 0); it is evidently impossible since, as soon as you try, the thigh has a tendency to rise, the pressure on the pedal remaining NIL!

(In fact, it is impossible to get a contraction of the calf if you do not contract, at the same time, the muscles which push the thigh downwards!). To succeed in applying pressure on the pedal, you must push downwards using a contraction of the thigh muscles. Conclusion: all the pressure on the pedal comes from the thigh only, the calf cannot make any contribution.

(Here, someone crafty could say: "if we want the calf contraction to create pressure on the pedal, all we need is to make the ankle into a point of support with the downward push of the thigh". That is what we are instinctively made to believe because this is what seems true: that's scenario #1, the one which seems visually true, being the one with the optical illusion; however, we have proven that this scenario #1 is false).

Now, let's reflect in terms of mathematical variations (x). Always in the same position on your bicycle, with brakes on, assume that you apply a downward pressure of 20 lbs with your thigh: according to the equations that we have demonstrated in section 3, the pressure on the pedal is 20 lbs (P' = 20) and the contraction of the calf is 60 lbs (M=3.C); from this position, try and increase the contraction of the calf to 63 lbs without increasing the contraction of the thigh (C remains at 20 lbs): it is impossible to increase the contraction of the calf to 63 lbs since the thigh raises as soon as you try to go beyond 60 lbs with your calf!

At the same time you must increase the value of C to 21 lbs simply to be able to increase the value of M to 63 lbs: in this case, the new pressure on the pedal is then 21 lbs and the contraction of the thigh is also 21 lbs, therefore, we can affirm that the totality of the pressure on the pedal comes only from the thigh (P'=C=21), the calf only supporting a tension (M=63 lbs) which is imposed by the downward push of the thigh.

We deduct the UNIVERSAL LAW OF PEDALLING :

"All increase in the contraction of the calf (M) must be accompanied by an increase in the contraction of the thigh (C) in order to be able to increase the pressure on the pedal (P'). Therefore, the increase of the pressure on the pedal produced (P') comes only from the increase in the contraction of the thigh (C). The increase in the contraction of the calf (M) is indispensable to make pedalling possible because the pedals needlessly maintain the heels free-floating. It is the intensity of the pressure on the pedal (P') which determines the intensity of the contraction of the calf (M), and not the reverse. The intensity of the pressure on the pedal (P') is determined uniquely by the intensity of the contraction of the thigh."

SECTION 5: Theoretical proof (by the absurd) that scenario #1 is false.

Referring to Fig 22: you have understood that the key to the mystery consisted in discovering that, visually, we totally ignore force M' (traction of the calf on the knee) since this force does not produce any visually perceptible movement (all this has been clearly explained at the beginning of section 2).

That being understood, let's us suppose something absurd: that the point of attachment of the top of the calf is OUTSIDE THE LEG, the bottom of the calf remaining attached to the heel! See Fig 30, which is simply a retake of Fig 26, except that the upper point of attachment of the calf is (y) located at the ceiling (Fig 30) while this point of attachment is the knee (13) in the case of Fig 26. Fig 31 is the schematization of Fig 30. (7) is the weigh scale on which the tip of the foot is applying pressure.

Fig 33: F is the pressure of the leg bone on the ankle and F' (Fig 32) is the reaction of F, i.e. the pressure of the ankle on the bone leg. Forces F & F' are not shown in Fig 31 since they cancel each other. The important point is as follows: the force of traction of the calf on the knee (M', Fig 22) is not shown on Fig 31 and 32 because of our absurd hypothesis: the application point of M' is at the ceiling (y, Fig 30).

Take note of this: the Fig 31, 32 and 33 are exactly the same as Fig 18, 19 and 20, the latter 3 figures having been used in the calculations demonstrating that scenario #1 seemed true in theory in addition to appearing true visually (that was the optical illusion); these calculations were done at the end of section 1 of chapter 8: we do not need to make the calculations a second time. This is important: if the top of the calf was attached outside the leg (at the ceiling), then the calculations done at the end of section 1 of chapter 8 would be correct and would contain no error: scenario #1 would then be true! Since the calf is not attached outside the leg (being attached to the knee), we conclude that the contrary is true and the scenario #1 is false!

Therefore, scenario #1 is false and scenario #2 is true. At this stage, you should be convinced, after all the experimental and theoretical proofs which have been given.

SECTION 6: Numerical comparison between the pedal and the INVENTION.

	THE PEDAL		INVENTION
	ERROR (world-wide interpretation)	The TRUTH (scenario 2)	
Downward pressure (C) applied by the thigh:	20 lbs	20 lbs	20 lbs
Compression on the ankle (F - M + P':)	20 lbs	80 lbs	20 lbs
Calf contraction (M):	15 lbs	60 lbs	0 lbs
Pressure on the pedal from - the thigh:	20 lbs	20 lbs	20 lbs
- the calf:	5 lbs	0 lbs	0 lbs
- TOTAL:	25 lbs	20 lbs	20 lbs

The first two columns of the table above concern the pedal and the last column concerns the INVENTION. The second column is the truth about the pedal, and the first column contains THE 2 ERRORS that we have explained (sections 1 and 2 of chap. 8), the first column being the world-wide interpretation (which is erroneous); to give a numerical value to this world-wide interpretation, we must start with the calculations at the end of section 1, chap.8 (which include the second error consisting of not visualizing force M') and add the first error which is to assign two uses to the downward force C applied by the thigh.

Calculations at the end of section 1 of chapter 8 yielded M = 15 lbs, P' = 5 lbs and F = 20 lbs, and these calculations assumed that force C = 20 lbs is directed along the leg bone and makes the ankle into a point of support (the compression on the ankle being force F = 20 lbs).

Let's add the first error which consists in supposing that force C = 20 lbs also applies pressure on the pedal (double usage). Therefore, according to this world-wide (false) interpretation, the total pressure on the pedal is made up of force P' of 5 lbs from the calf plus that from the thigh (i.e. 20 lbs), for a total of 25 lbs.

The whole world (first column) UNDERESTIMATES enormously the DAMAGE caused by the use of the pedal:

- with the pedal, the real compression (column 2) on the ankle is 80 lbs compared to 20 lbs for column 1: that's four times greater! The invention brings this compression back to 20 lbs (thanks to the elimination of the use of the calf); therefore, this invention reduces by a factor of FOUR the compression on the ankle, that is excellent for older people.

- the whole world thinks that the contraction of the calf is only 15 lbs (column 1); in reality, this contraction is 60 lbs, that's four time greater! Fortunately, the invention brings the contraction of the calf back to ZERO, thus resulting in a fabulous energy saving, and this without loss of propulsive pressure since the calf does not contribute any pressure on the pedal, as we have amply demonstrated!

SECTION 7: The universal law of the crankset!

The universal law of pedalling demonstrated earlier deals with the calf. The universal law of the crankset that we will now explain is much more general and allows the understanding of another grave error which currently exists in cycling, and which confuses everything, i.e. the crankset is often associated (by mistake) with a motor while it is simply the transmission! And we will see that this has grave consequences. This universal law of the crankset is associated with a SECOND optical illusion!

Actually, there are TWO optical illusions which hold cycling in slavery; you know the first one, which deals with the calf.

This second optical illusion of the crankset concerns cycling in general and amplifies the devastating effect of the optical illusion of the calf, since these two illusions are interdependent and amplify each other into an inflationary spiral, thus completely blocking the true understanding of what the word pedalling really means!

Indeed, we will see that, by considering the leg with the crankset, the first illusion makes one falsely believe that the calf, in contracting, increases the pressure on the pedal and that the second illusion makes one falsely believe that the power of the bicycle is increased because the new crankset has a longer crank: this second optical illusion consists in not being able to visualize that, if we lengthen the crank, the displacement of the pedal axis is shorter, thus canceling the effect of its lengthening: the power of the bicycle remains the same! That is what we will now demonstrate. Be ready for some real surprises!

Let's make the following analogy: we will say that the universal law of pedalling is equivalent to the narrow theory of relativity, and the universal law of the crankset is equivalent to the general theory of relativity! Indeed, these 2 laws of cycling will have a powerful impact, as much as the theory of relativity had in physics!

Hard to believe but true: patent examiners (scientists who are indeed very competent) approve patents for stupid inventions that do not improve anything (except in appearance, visually speaking), as we will demonstrate with a typical example!

The inventor has in his possession dozens of patents that were granted in cycling and all of them have been granted because the patent examiners have been induced in error (against their will, of course) by the great power of this second optical illusion which comes into play when we look at the crankset, illusion which makes us falsely believe that the crankset is a motor, that it can provide energy by itself!

Here, we will give only one example: an invention which has been patented in 8 countries signifying that 8 patent examiners have ALL been induced in error, INDEPENDANTLY of each other!

We will see that the two illusions (that of the calf and that of the crankset) have an OPPOSITE EFFECT. Indeed, the calf illusion makes one believe that the mechanism of our invention is useless when we look at it, and the crankset illusion makes one believe that the invention patented in 8 countries is very useful because it proposes a longer crank!

In reality, **the reverse is true:** the mechanism of our invention is **very useful** (although, **visually,** it seems **useless!**), and the crankset with a longer crank is totally **useless** although, **visually,** it seems **useful!** The world in turmoil, sort of...

Fig. 35 is taken from the JENTSCHMANN patent DE, A, 3,241,142 (1983). The examiners who granted this patent have been induced in error by the OPTICAL ILLUSION OF THE CRANKSET, making them believe that the crankset is the motor, which can produce energy by itself, simply by lengthening the crank!

The truth is that the crankset is part of the transmission; the crankset can fulfil only one role: to transmit to the wheel the energy received from the motor, which is human. The crankset is simply an intermediary which transfers energy received from the human motor to the rear wheel. Whether the crankset is round, square, oval, vertical, with a longer crank or whatever..., it can only transmit to the wheel the energy which it receives from the motor. "It is evident" you will say! Well no!

It is not evident, here is the proof, which will highly surprise you! Fig 35: the pedal is attached to one end of a L-shaped rigid piece (part H); the other end of that L shaped part slides along a slot in the vertical tube of the bicycle frame. The result is that the pedal axis follows a trajectory (T1) in the shape of the letter O (a bit like an egg or some kind of ellipse), while, with a regular circular crankset (i.e. crank of a fixed length), the trajectory is a circle (T2). The evident visual purpose of this mechanism is to augment the effective length of the crank during the most effective phase of the pedalling cycle (when the foot moves down and forward), and to shorten the crank when the foot comes back up from the rear.

The "reasoning" followed by this inventor is simple: if the crank is indeed longer when the foot moves forward and down, then the leverage effect is increased, which should increase the power compared to the circular crankset ("the leverage effect" is the length of the crank times the force perpendicular to this crank).

It is correct to say that the leverage effect is increased, but it is false to say that the power is increased because our eyes forget to see something else: we do not visually perceive that, if we lengthen the crank, then the displacement of the pedal axis is shorter, thus cancelling the effect of lengthening the crank. The work provided does not vary and, therefore the power does not vary (work being the product of a force by its displacement in the direction of the force), taking an identical basis for comparison, i.e: the work provided by the leg does not vary.

Once again, the crankset is the transmission. If the motor (the leg) provides the transmission (the crankset) with a certain quantity of work (energy) in a given time interval (therefore a certain power), the only thing that the transmission (the crankset) can do is to transmit this power to the rear wheel; THE CRANKSET IS NOT A SOURCE OF ENERGY: only the motor (the leg) provides energy.

Lengthening the crank will not vary the power transmitted by the leg since a transmission cannot add power... If one wants to increase the power of an automobile, one must increase the power of the motor: modifying the transmission will achieve nothing! In the PARTICULAR CASE of the human motor:

a) it could be possible to increase the power if the modification made to the transmission (the crankset) allows the use of new muscles which were not used before the modification. It is evident that neither of the mechanism of Fig 34 nor the one of Fig 35 allows the use of new muscles, compared to the usual circular crankset: therefore these mechanisms do not increase the power.

b) however, it is possible to increase the energy efficiency of the human motor if we discover that a given muscle (the calf) does not provide any work (it does not increase the pressure on the pedal) and, therefore, wastes energy by contracting: it suffices to eliminate the use of this useless muscle (this is achieved by the mechanism of Fig 34 and not possible with the mechanism of Fig 35 since the heel remains free floating), thus increasing the ENERGY EFFICIENCY of the human motor. This is the equivalent of decreasing the gasoline consumption of a motor (by eliminating a leak, for example) which develops a certain power: the power remains unchanged, but the energy efficiency has increased.

We will now visually demonstrate all of this, by explaining the optical illusion of the crankset. All propulsive energy can only come from the motor, and the crankset can only transmit the energy received from this motor (the leg). However, we have amply proven that the CALF IS USELESS: therefore all of the propulsive energy can only come from the thigh.

Fig 36 is a schematic representation of a leg applying pressure on a circular crankset which has a crank of length M1: the thigh (6) (the only motor, the calf being useless) pushes downwards along angle , going from the position shown with a heavy line A to the position shown with a dashed line. The only thing which changes in Fig 37, is the length of the crank M2.

The downward pressure applied by the thigh (6) is assumed to remain THE SAME for both figures 36 and 37, and the angle is also THE SAME; therefore, the work (or the energy) provided by the thigh (the only motor, the calf being useless) is exactly THE SAME in both figures. Therefore, each of the two cranksets receive the same quantity of work (or energy): each of the two cranksets is a transmission, and can only transmit to the rear wheel the energy which it receives from the thigh, which, by hypothesis, is the same in the two cases.

Do you notice something interesting? What makes the bicycle go forward? The displacement of the pedal axis: if the pedal does not move, the bicycle remains steady!

Can you VISUALIZE that the DISPLACEMENT of the pedal axis is GREATER in the case of Fig. 36 (arc C1) than that of Fig.37 (arc C2) for THE SAME WORK provided by the motor (i.e: the thigh)?

Lengthening the crank REDUCES the displacement of the pedal! (The LENGTHENING of the crank on Fig. 37 has been greatly exaggerated so the we can better VISUALIZE the difference in the length of arc C1 and C2). It is correct to say that the leverage effect (the force on the pedal multiplied by the crank length) is greater in the case of Fig. 37, however this effect is cancelled by a shorter displacement of the pedal axis, such that the work provided to the rear wheel by the two cranksets is exactly the same!

It must be so since the two cranksets (which are transmissions) receive exactly the same amount of energy (work) from the thigh (which is the only motor, the calf being useless) by hypothesis the angle and the downward pressure by the thigh are the same in the two cases.

Therefore, irrespective of the length of the crank, the work provided to the rear wheel is constant, and this work is always equal to the work that the crankset receives from the motor (the thigh only),(ignoring the losses by friction: here, we are evidently talking theory). It is logical and unavoidable...

The inventor of the mechanism of Fig 35 and the patent examiners who have granted this patent have committed the error of relying on their eyes only! When we look at a leg applying pressure on the crank of a crankset which has been lengthened, our mind has a tendency to perceive only what is VISUALLY apparent, in other words the elongated crank with the greater leverage effect.

Our eyes perceive the static (what does not move) and not the dynamic (what moves, i.e: the displacement of the pedal): our eyes do not perceive the SHORTER displacement of the pedal axis when the crank is LENGTHENED! That is the OPTICAL ILLUSION OF THE CRANKSET

On a lighter note, let's make the following analogy, we see an apple falling from a tree: we conclude that the apple travels towards the earth, but we do not visualize that the earth is also travelling towards the apple since this displacement is infinitesimal (in addition, the observer moves with the earth, thus preventing him to perceive its displacement).

To visualize the shorter displacement of the pedal axis when the crank is lengthened, the observer would have to visualize TWO bicycles simultaneously, the first with a crank of normal length, and the other with an elongated crank, and the observer would have to be extremely....observant!

Fig 34: the mechanism which supports the rear of the platform (21) is not shown (this will discussed in detail later); by replacing the pedal by a platform which supports the heel, the contraction of the calf is eliminated, thus increasing the energy efficiency of the motor without reducing the pressure on the pedal since the calf does not contribute to this pressure: we spend less energy to obtain the same pressure.

Therefore the platform is useful although the mechanism visually appears useless: indeed, for the man on the street who thinks that the calf contributes to the pressure on the pedal, the first impression is that this platform prevents the use of the calf and therefore translates into a loss of pressure! In addition, the man on the street does not perceive the (false) leverage effect which is supposed to "increase the power", as in the case of Fig. 35! Therefore, the platform of our invention seems totally useless and possibly harmful (sic) for the man on the street (even the expert) who ignores the content of the document you are now reading.

In the case of Fig 35 (elongated crank), the man on the street visually believes that this invention is very useful although it is totally useless.

The crankset modification, which consists in lengthening the crank, does not in any way change the energy efficiency of the human motor because, before and after the modification, the calf and the thigh continue to work in the same manner: the calf continues to contract uselessly. Therefore, this crankset modification brings no improvement: it is completely useless although it appears visually very useful due to the optical illusion of the crankset!

CONCLUSION:

Fig. 34: For those who ignore the content of this document, this platform which supports the heel visually seems useless (even harmful) due to the optical illusion of the calf. The truth is that it is extremely useful!

Fig. 35: For those who ignore the content of this document, this mechanism visually seems very useful due to the optical illusion of the crankset. The truth is that this "genial" mechanism is totally useless!

To achieve a real improvement, a modification to a crankset, regardless of its nature, must modify the use of the muscles of the human motor; this can be accomplished in two ways:

1- by allowing the use of muscles which were not previously used (before the modification to the crankset): in this case, it would be an added energy source, or an increase in power.

2- by eliminating the use of muscles which have little use (of little energy efficiency) or completely useless (as is the case for the calf): in this case, there is an increase in the energy efficiency, and not in power.

This is logical and unavoidable...

Something for the experts to really think about! We must point out that a lot of cycling experts are working hard at improving the "efficiency" of the calf, an efficiency which is non-existent, a pure illusion! They are attempting to IMPROVE something which should be ELIMINATED! Is this dramatic or comical? You be the judge. And what should we think of all the attempts at creating the crankset of the 21st century, by falsely believing that the crankset is a motor as if it could provide energy by itself? This is tragic...

THE UNIVERSAL LAW OF THE CRANKSETS:

"A crankset is not a motor; a crankset is part of the transmission, an intermediary between the motor (the thigh which provides the energy) and the rear wheel (which receives this energy): the crankset cannot add energy by itself.

Therefore, the energy provided by the motor (the thigh alone) is always equal to the energy received by the rear wheel (not taking into account friction losses), regardless of the design of the crankset (the transmission) which is only an intermediary that transfers the energy from the motor to the rear wheel. Therefore, to make a real improvement, a modification to a crankset must directly modify the use of the motor muscles, that is:

- by allowing the use of muscles which were not or little utilized before the modifications to the crankset, corresponding to an increase in available power,

- by eliminating the use of muscles with a weak or non-existent energy efficiency (as is the case of the calf which cannot contribute to the pressure on the pedal). irrespective of its visual appearance, if this crankset does not directly modify the use of the motor muscles, it is useless."

This universal law of the cranksets is extremely practical since it allows, at first glance, to determine if a new crankset brings a real improvement, without having to carry out an extensive technical analysis! If they had known this universal law of the cranksets, the examiners would have immediately rejected the invention of Fig 35 since it would have been evident that this invention does not modify the use of the leg muscles, compared with the conventional circular crankset: the thigh and calf muscles continue to be used in the same manner, there is no addition of muscles which were not used before, nor elimination of useless muscles (like the calf), nor any evident improvement in energy efficiency of muscles already being used! This invention (Fig 35) is useless.

However, if we apply the same universal law of the cranksets to the mechanism of our invention (Fig 34), which essentially accomplishes one thing: support the heel in order to avoid using the calf (for clarity, the mechanism which supports the rear of the platform (21) is not shown), then it is evident that the platform eliminates the use of the calf, a useless muscle, thus greatly increasing the energy efficiency of the motor; therefore our invention is very usefull!

To demonstrate this law is universal, we have used the particular case of the elongated crank. However, this law applies to all types of cranksets: vertical displacement, elliptic, square, triangular ... whatever you wish.

This law also applies to all other parts of the transmission, the crankset being only one part thereof. The definition of the optical illusion of the crankset which we have previously given, i.e."...not to visualize that the lengthening of the crank results in a shorter displacement of the pedal axis..." was a particular case of the optical illusion of the crankset. We could GENERALIZE this definition to all types of cranksets (elliptical, vertical etc...) by stating that: "...it is the fact that we are visually mislead by the appearance of the crankset that we are inclined to believe that the crankset is an ENERGY SOURCE..."

CONCLUSION (in the case of the elongated crank):

While looking at a leg pressing down on a crankset with a crank elongated by some kind of mechanism, two optical illusions trick us: the illusion of the calf which makes us believe that the contraction of the calf increases the pressure on the pedal, and the illusion of the crankset which makes us believe that the elongated crank increases the power of the bicycle, that being totally false.

In addition, these two optical illusions are dependent of each other and amplify each other in an inflationary spiral: indeed, the lengthening of the crank leads us to falsely believe that the "contribution of the calf" to the pressure on the pedal is even more efficient precisely because of the lengthening of the crank! All this is totally false...

Because of these TWO optical illusions, cycling is held hostage and is moving in the wrong direction!... And to say that the experts think that the current bicycle is nearly perfect...! How tragic !!!

SECTION 8: how the optical illusion of the calf is transformed in a muscular illusion (and other subjects).

Why is the optical illusion of the calf so powerful? Before the pedals, it was the "draisienne": 2 wheels and an horizontal wooden beam on which one would sit, and the vehicle was propelled by walking or running, as with a "trotinette", by alternatively placing the feet on the ground.

Then someone had the idea to use pedals. Indeed, the introduction of the pedals was considered as a major innovation, and this was true, but only with respect to the "draisienne": if they had known about our invention at that time, the pedals would have been considered stupid (as they are!).

People were euphoric; they were so pleased to have the pedals, the change from the "draisienne" was so radical that they thought that never would these extraordinary pedals be ever replaced by something better in the future! Therefore, from the start, more than 100 years ago, it was admitted by all that the pedals were perfect for use by the human leg; and this is so true that no one had the idea to try and replace them with something else.

To this initial euphoria, we must add the optical illusion of the calf which already existed when pedals were first used to create the bicycle; indeed, the first pedals were invented several thousand years ago: therefore, the optical illusion of the calf exists since that time, which is what explains its power.

Look at someone walking on the street: he/she places the heel on the ground at each step, since this is the normal way to walk.

We would immediately notice someone who would walk continuously on the tip of the foot, without placing the heels on the ground, and we would not miss the opportunity to let that person know that his/her way of walking is not normal! The same applies to climbing stairs: it is normal to place the heels on the stair and it is not normal to place only the tip of the foot on the stairs, with the heel free-floating. Why is it then that people find it normal to pedal with the heels free floating, whether on a hill or flat terrain? YOU KNOW THE ANSWER...

The image of someone pedalling in a so-called "normal" fashion (the tip of the foot on the pedal) has been deeply encrusted in our mind since our very tender age when we all saw cyclists pedalling. When a young child sees something for the first time, it remains forever in his/her mind. The optical illusion of the calf has been transmitted intact from generation to generation: time has contributed heavily to the power of this illusion. As if this were not sufficient to explain the power of this illusion, we must add another important factor, a muscular illusion (this expression is from my invention), that we will define as follows:

"to have the physical (muscular) impression that a given muscle plays a certain role while, in reality, it fulfils another role."

In other words, the reality contradicts what we physically feel when we use that muscle. A muscular illusion is not "a thought": we do not reflect on it: it is a physical impression, purely muscular.

It is the muscle itself that seems to convince us that it fulfils a well defined role when, in reality, it has another function. When an observer sees someone pedalling, the calf produces an optical illusion on the observer; for the person who is pedalling, who is "working the calf", this optical illusion of the calf is transformed into a muscular illusion:

- the observer: the optical illusion gives the impression that the cyclist's calf applies pressure on the pedal.

- the cyclist: the fact of "working the calf" seems to physically indicate to him/her that the calf applies pressure on the pedal.

In the 2 cases, it is exactly the same illusion, but perceived in a different way, depending on whether one observes or pedals!

What is the importance of all this? It is a major factor in explaining why this illusion of the calf is so powerful. Indeed, we all have climbed a bicycle when we were young and we have been heavily influenced by this optical/muscular illusion as soon as we have tried to climb our first steep hill, without success and completely exhausted: while climbing, we were absolutely convinced that your calves were used to increase the pressure on the pedals since this was the message that our calves were giving us by exhausting us and by reinforcing the optical illusion that we had stored in our subconscious mind for a long time, since the very first time that we saw someone pedalling (i.e. at a very young age)!

The muscular illusion of the calf is much more powerful than that of the optical illusion of the calf; if, for example, you break a leg (which is very painful), you will remember the incident for a very long time, surely much longer than if you had seen someone break a leg: when one suffers physically (as in the case of working the calf hard), the effect on your mind is much more powerful than a simple visual perception.

Since our childhood we all have been heavily influenced by the two aspects of the same illusion of the calf (optical and muscular), these two aspects amplifying each other into a inflationary spiral.

That explains why the enormous power of this illusion and, consequently, why billions of people for the last 100 years have not discovered the existence of this illusion!

After all the serious discussions of the previous pages, we need to relax a little bit; what follows is "comical" but also "serious". Mister X wears a prosthesis for the lower leg; suppose that he volunteers to have the second lower fitted with another prosthesis: the bad news is that he would have difficulty to stand up as he would not have any calves; the good news is that he would spend two times less energy while pedalling since, as the Universal Law of Pedalling states, all the pressure on the pedal comes strictly from the thigh, the calf having no contribution. The world of cycling has two possible choices when facing this waste of energy that is denounced by the Universal Law of Pedalling:

1- that all cyclists volunteer to have their 2 lower legs amputated at the knee and have prosthesis fitted, while continuing to use pedals,

OR

2- keep our legs intact and simply replace the pedals by our invention (which supports the heel).

The first solution consists in removing the problem by loosing our calves: this is equivalent to accelerating the Darwin theory of evolution! If this theory is correct, it would suffice to wait a few million years so that the leg "evolves" by gradually getting rid of the calf so that the leg gradually adapts itself to its environment which is the bicycle! Is this not preferable to do the inverse, i.e. make sure that man adapts its creation (the bicycle) to its environment which is the human leg (with its calf), simply by replacing the pedals by our invention (the platforms supporting the heels)? The Homoplatformus is therefore the man with calves; according to Darwin, in several million years, he will become the Homopedalus (a man without calves): he will have evolved...

This is out of context, but it better prepares us for what follows. With respect to this theory of evolution, we can ask ourselves some strange questions, for example:

- are living organisms influenced only by the natural creations in the environment or are they also influenced by man-made creations? For example, can an organism adapt itself to pollution created by man? If the bicycle remains unchanged (with pedals) during the next few million years, will that have an effect on the evolution of the human leg? If so, it is a sure bet that the "evolution" of the calf will tend towards its strengthening (calves will become enormous) as opposed to their elimination, that will not go too well with women!

If humanity runs out of drinking water, will we have to wait until our organism "evolves" so that we can drink salted water? Or will salt water "evolve" to finally become drinkable (let's hope that this won't take too long!).

It is wrong to pretend that only living matter can evolve; indeed, inert matter continuously evolves in the heart of stars via nuclear reactions (hydrogen becomes helium etc...). There is one thing however which does not evolve at all: the human mind (humans always kill each other: man is self-destructing). We are forced to conclude that, since the human mind does not evolve, it is not material! Only a God creator can make the human mind evolve (in the right way): however, one must ask!

Let's leave this discussion which could take us too far off our invention (but there is indeed a link between the two, and this is why we have briefly touched the subject). There are negative people who will do EVERYTHING to discredit creative efforts. Someone told me: "... you are wasting your time with your invention; a company just put on the market a bicycle with pedals equipped with a complementary small electrical motor and battery: when pedalling and the motor is not in use, the latter is transformed into a dynamo to recharge the battery. A portion of the energy spent to pedal is used to recharge the battery".

My answer was:

"If this bicycle uses pedals, then each Kwatt/hour of energy stored in the battery requires twice that amount in human energy spent to produce this Kwatt/hour: Two Kwatt/hour of human energy are required to produce only one Kwatt/hour of stored energy, simply because pedals are being used, which forces the calves to work (with no need): it is a pure waste! And the same goes for the rest of the energy spent while pedalling to propel the bicycle forward, this energy is twice what is necessary: more waste!".

The ideal would be to use the two concepts together: use the platforms of our invention and the motor with its battery: in this way, the amount of energy required to recharge the battery would be half and the energy efficiency of the pedalling action would be doubled.

Our invention is a basic one which does not preclude complementary inventions! While we are at it, why not replace this electrical motor with a gasoline motor? One either wants some physical exercise or go motorcycling! When someone buys a bicycle, it is usually to do some physical exercise in silence and a person buys a motorcycle for different reasons: we must not mix the concepts in order to discredit an invention! One thing is certain: as far as man-propelled vehicles are concerned, it is stupid to spent twice as much energy than necessary when this could be avoided by using the platforms of our invention!

Another negative person made the argument of the weight: "... if you replace the pedals by these platforms and its driving mechanism, the bicycle will be HEAVIER".

Let's suppose (and exaggerate) that the bicycle's weight goes from 20 lbs to 25 lbs if we replace the pedals by this invention: it is an increase of 25% in the weight of the bicycle, and that is insignificant compared to the increase of 200% in the energy efficiency; in addition, this 25% is hiding something! Indeed, is the bicycle running by itself, without a cyclist? Of course not: we must take into account the weight of the cyclist in addition to the weight of the bicycle; the human energy that you spend propels the bicycle and you too!

Suppose that you weigh 150 lbs and the bicycle 25 lbs, the total weight is 175 lbs; therefore the invention (5 lbs more, in exaggeration) adds only 2.8% and not 25% as calculated above; this 2.8% increase in weight is a very small price to pay for a bonus of increasing by 200% the energy efficiency realized by eliminating the use of the calf!

The reasoning is similar for climbing hills: you climb the hill with your bicycle (if you decide to remain at the bottom of the hill and tell your bicycle: "climb by yourself", I would think that your mental health is deficient)!.

Cyclists (except young people perhaps) spend 95% of the time on flat terrain: they avoid hills. However, on flat terrain, we do not have to work against gravitation, but only against mass inertia, according to Newton's formula F = m.a where m is the mass and a is the acceleration.

On flat terrain, an increase in weight is less significant than on a hill; on a flat surface, the weight is a measure of the mass. As per F = m.a, the greater the mass, the smaller the acceleration for a given force F. Therefore, on a flat terrain, the increase in weight affects only the level of your acceleration: you take a little more time to reach a certain speed; it is the only disadvantage; if the increase in weight is only 2.8%, then the additional time required to reach a certain speed is hardly noticeable! The only sport where the weight of the bicycle is important is the sprint races with acceleration of short duration like those closed-circuit races in Japan!

Contrary to what we believe, the weight of bicycles is not important in the long distance races, as in the Tour de France! Indeed, on long distances, the loss of acceleration is eliminated because the energy is conserved: the greater the bicycle's weight, the greater its kinetic energy 1/2 $m.v^2$ since m is greater; then that bicycle can travel a greater distance than the lighter bicycle before stopping when the 2 cyclists stop pedalling: with respect to the average speed which determines the result of the race , the heavier bicycle is not at all disadvantaged if the race is on a long distance, and the same applies to hills: the cyclist riding the heavier bicycle spends more energy than the one with the lighter bicycle, however, after reaching the top of the hill, the potential energy of the heavier bicycle is greater: it is reserve energy that the cyclist will use to compensate for spending more energy during the climb. The energy is conserved!

Therefore, the argument with the weight is insignificant. Then why this publicity surrounding super light bicycles? For 2 reasons: because there is money to be made and that the cycling experts have nothing else to do (nothing important) !

The general opinion in the industry is that the current bicycle is nearly perfect, and that there are no possibilities of major improvements (this document will surprise them to the highest degree!), except for details in how to improve aerodynamics, adding suspensions ... and reducing the weight using new materials! The weight argument is especially interesting from the commercial point of view. The first reaction a lady had when seeing the prototype of my invention was: "Will your invention help me lose weight?"; people are increasingly preoccupied with their weight as they are pressured by advertising (super thin models, a slender man...) and they easily associate light weight with the term light bicycles: all that is "light" creates interest in people. This disproportionate love with something light allows manufacturers to demand excessive prices for their "super-light" bicycles: a real gold mine!

Together we have made a theoretical study of the functioning of the leg in the preceding pages by calculating translation and rotation equilibrium; we also have theoretically demonstrated the two errors in the world-wide interpretation, we have proven that scenario #1 is false and that scenario #2 is true in two ways (a normal proof and a proof by the absurd). A question naturally comes to mind:

Were such theoretical studies of the functioning of the leg not carried out in the past by experts in cycling and bio-mechanics? Surely. Therefore this is only one possible explanation: they did not discover the truth explained in this document since, had they discovered that truth, there would no longer be any bicycles with pedals on the roads! And there are only bicycles with pedals on the roads!

Therefore, this proves the extremely powerful effect of the COMBINAISON of the three illusions, i.e:

1- the OPTICAL illusion of the calf,
2- the MUSCULAR illusion of the calf,
3- the OPTICAL illusion of the cranksets,

these three types of illusion influencing each other in an inflationary spiral: this is holding today's cycling IN SLAVERY; cycling is going in the WRONG direction!

The transmission (the crankset) of the current bicycles with pedals is not fit for the particular type of motor used (the lower limb): with a Rolls-Royce motor, one does not use a Wolkswagen transmission!

This document is a source of well oxygenated fresh water pouring into an ocean polluted by pedals "with automatic release", with cranksets which we think as of motors, a weight argument of little importance, special techniques to climb hills etc...

Yes, this document is the most important paper on cycling for the last 100 years, and puts into question the very foundations of this industry!

Happy journey to the futur users of this invention!

As you have realized, the explanation of our scientific discovery concerning the calf implies various considerations, including the role played by visual perception, the way our mind works, some scientific calculations etc...

There also exists another factor of a psychological nature involving the human nature which allows us to answer the question that was asked on the previous page, i.e: « Have theoretical studies on the functioning of the leg been done in the past by cycling experts and bio-mechanics? » Surely.

However, our psychological factor will allow us to understand why they have not discovered the truth explained in this document.

We shall baptize this psychological factor the Unconscious Intellectual Vanity (UIV), an affliction which we shall designate by UIV.

This UIV is unconscious since the affected people **do not know** that they are afflicted, thus eliminating the possibility of a cure: it is therefore an incurable affliction! The more learned people are, the higher their UIV is; and if you tell these people that they are afflicted by UIV, they will not believe you ... because of the affliction itself ... which prevents them to discover that they are afflicted: **an infernal vicious circle!**

What does this have to do with inventions in general and ours in particular? A DIRECT IMPACT! This UIV prevents technical progress by building a psychological cement wall (nearly impossible to break down) between the inventor and his audience: communication becomes very difficult with inventions in general and nearly impossible in the case of inventions involving optical illusions, as we shall see.

Normally, a mental affliction would make the person suffer. The problem with UIV is that it is not the afflicted person that suffers: the inventors are the ones who suffer from this useless vanity!

What is the origin of this affliction?

Can you calculate the value of X in the following equation within 2 seconds, no computers, using your mind only?

$$X = \mathop{}_{y=0}^{10} \mathop{}_{x=0}^{x=y} \frac{(e^x + x^5 + (1 - \cosh x))\; y^e\, dx.dy}{(\text{artg } x)^{10}}$$

I am personally incapable, evidently, you too. Why? Because our mind is of LIMITED power. Our limited mind prevents us to discover that we have ... a limited mind!!!

The result is that people believe (unconsciously) that the power of our mind is without limits, that it suffices to "develop" it in some way by using brain cells more effectively ...; this ends up by producing UIV, drop by drop, slowly over years, in a cumulative process, all unconsciously: people are not aware of it! The more a person studies in a given speciality, the more that person persuades oneself (unconsciously) that he/she is more and more infallible in that speciality (since learning accumulates), and that, if there was something to discover in his/her domain, someday that he/she would make that discovery ...

This process of "unconscious auto-conviction" is amplified by the passing years although the person does not give the impression of taking oneself seriously, not showing any exterior signs of vanity.

This UIV, is just like an optical illusion: in both cases, it is impossible to discover its existence by ourselves, this must be revealed to us by an external agent!

We are all afflicted by UIV to varying degrees (including myself!), without realizing it. The unfortunate result is as follows: if an independent inventor proposes to an expert to study an invention in his speciality, this expert will immediately take a look at the drawings since an image is supposedly worth 10,000 words and this is the fastest way to satisfy his curiosity; if the drawings involve an optical illusion, the expert will be tricked without knowing it, he will have the tendency to skip reading the inventor's written explanations for two reasons:

1- he is convinced that the invention has no value evidently because of the optical illusion,

and

2- the perversity of the UIV is active: his unconscious mind convinces him that he knows all there is to know is his speciality, and that it is certainly not a "small independent inventor" (who is not expert in his domain) who will teach him something new!

That is the unconscious message carried by this UIV, and this expert is not aware of anything, not showing any signs of vanity, seeming consciously convinced that he is open to any new idea! What a paradox! The conscious and the unconscious contradict each other, the conscious being open to novelty and the unconscious blocking the process to progress!

Therefore, the expert does not read the written explanations from the inventor and automatically rejects an invention which could bring progress to humanity; the victim of the UIV is the inventor and, indirectly the whole humanity if the inventor is discouraged in the face of this apparent failure.

This apparent failure can be transformed into a victory if the inventor is made aware in advance of the possible reactions of the expert with respect to the optical illusions and this famous UIV; if the inventor is aware, he knows that this apparent failure is in reality a victory since the rejection by the expert proves the existence of the optical illusion within the drawings, this creates a fabulous potential associated with this type of invention, inventions based on the discovery of an optical illusion being very rare!

This implies that the inventor should rejoice in learning of the rejection of his invention by the expert: a rather bizarre situation which defies logic, is it not?

In the case of inventions (or discoveries) not involving optical illusions, rejections by experts seem to indicate the existence of a hidden phenomena, which could be the UIV! This appears to have been the case with Einstein's narrow theory of relativity: indeed, all physicists to whom Albert Einstein provided his document have rejected the theory (about 20 physicists).

The affliction of the expert, the UIV, prevents him to understand that this independent inventor, non-expert in his domain, with a mind of very limited power, has the advantage of a mind which is fresh and rested, while the expert's mind is awash with superficial details; the inventor is more like an explorer of the expert's speciality and perceives the domain of study in general terms, thus allowing the inventor to find faults in the structure much easier than the expert.

Analogy: if a skyscraper is tilting and risks to fall due to soil failure, someone in the skyscraper studying the quality of the concrete (the expert) has little chance to perceive the building's tilt, while someone in the distance (the inventor) who sees the whole skyscraper could see the dangerous tilt of the building: the inventor distances himself from the domain under study to see it in its totality, while the expert is awash in the details within the domain under study!

Here is a practical application. In the case of our invention, we must distance ourselves from cycling to visualize the general situation in order to realize that something is fundamentally wrong with cycling; this begins by the study the functioning of the leg without the bicycle, observing how people walk, run and climb stairs: that is what we mean by distancing ourselves from cycling!

As for experts in cycling, they study cycling with the bicycle as the main focus, which seems logical at first glance: what expert would have the "bizarre" idea to study cycling without a bicycle?

To discover that something is wrong with the design of bicycles, we must distance ourselves from the bicycle and concentrate on the motor (which is the lower limb) and study it for what it is: a universal motor which is also used in walking, running and climbing stairs; importantly however, only pedalling involves the use of a transmission (the crankset), not walking, running or climbing; we then discover that this transmission has a faulty design and is not appropriate for this type of universal motor (the lower limb) and it is impossible to discover the uselessness of the calf if we study only the interaction between the lower limb and the bicycle (because of the optical and muscular illusions) without accounting for the other aspects of the universality of the motor (walking, running and climbing).

It is possible that a lot of specialists in cycling, especially those afflicted by UIV in its terminal phase (!), decide not to study the lower limb in its universality for the following reasons:

1- the functioning of the lower limb seems so elementary and visually evident that, if there was something fundamentally important to discover, it would be obvious!

2- since we cannot modify the lower limb (except by surgery!), why study it?

Therefore, the experts study what they can modify, i.e. the bicycle itself, excluding the lower limb, which tends to make them believe that the crankset is the motor: the optical illusion of the crankset is born!

To complete this SECTION 8, there is a dessert, and it is SUCCULENT: the cherry on the sundae! Indeed, in addition to multiplying by two the energy efficiency (at minimum) which the invention's platform produces by eliminating the use of the calf, the same platform also allows the doubling of the power: a true miracle! Thus we can double both the energy efficiency and the power! How can this feat be possible? By actively using both phases of the pedalling cycle!

Fig 38 symbolizes the descending phase for a regular circular crankset: the pedal (15) is pushed downward going from the upper neutral position (HI) to the lower neutral position (LO); it is this descending phase which has been our subject since the beginning of this document, and we have concluded that the pedal needed to be replaced by a platform which supports the heel in order to avoid the contraction of the calf, thus doubling the energy efficiency.

Fig 39 symbolizes the ascending phase, when the pedal (15) goes from the lower neutral position (LO) to the upper neutral position (HI); evidently this phase can be active only if the foot is attached to the pedal.

Fig 40 represents the leg of a cyclist whose foot tip (the toe joints on the pedal axis) is attached to the pedal by a strap (24), allowing the cyclist to pull the pedal upwards, this propulsive force adding to the downward push of the other leg: thus, the two legs work simultaneously for propelling the bicycle.

During this ascending phase (Fig 40), the two main muscles which are being used are:

1- the anterior tibial muscle schematized by item (23), which flexes the foot or, if you prefer, the muscle which is used to lift the tip of the foot; it is the antagonist of the calf (4, Fig 41): the calf (4) and the anterior tibial muscle (23) fulfil antagonistic roles, the calf pushing the tip of the foot downward while the anterior tibial muscle pushes it upwards.

2- the iliopsoas symbolized by item (22) Fig 40 is used to lift the thigh; it is the antagonist of the gluteal muscles (5, Fig 41): the gluteal muscles (5) and the iliopsoas (22) fulfil antagonistic roles, the gluteal muscle (5) pushing the thigh downward while the iliopsoas pushes the thigh upwards.

The iliopsoas (22) is a powerful muscle made of two parts, one originating from the anterior side of spinal column (back abdomen wall), the other originating from the anterior part of the pelvis with a common tendon on the thighbone; we note an interesting result:

If we make maximum use of the iliopsoas in order to pull the pedal upward (Fig 40), this has the tendency to strengthen the abdominal muscles, thus reducing the waistline!

However, there is an enormous problem with the classic concept of Fig 40, that is, the use of a strap to attach the foot to the pedal and, to better understand the problem, let's go back to our conclusions with respect to the descending phase (the useless role of the calf) and understand that, for the ascending phase, the anterior tibial muscle (23) is totally useless in increasing the upward traction on the pedal, the totality of this upward traction coming uniquely from the iliopsoas (22).

Fig 42 symbolizes a leg applying pressure on the pedal during the descending phase; only the muscles being used during this first phase of cycling are symbolized (the calf 4 and the gluteal muscles 5); we also have A/B = 3. Fig 43 symbolizes a leg pulling the pedal upward during the ascending phase, thanks to the strap (24); only the muscles being used during this second phase of cycling are shown (anterior tibial muscle 23 and the iliopsoas 22); we also have A/D = 3, A being the distance between the ankle (1) and the pedal axis, and D being the distance between the ankle (1) and the average point of attachment of the tendon of the anterior tibial muscle (23) onto the foot bone. Fig 41 is simply a combination of Fig 42 & 43.

THIS IS IMPORTANT:

- with respect to Fig 42, we have amply proven that:

  i) the calf (4) is useless for increasing the pressure on the pedal and, therefore, energy is wasted; we have solved the problem of wasted energy by replacing the pedal with a platform which supports the heel in order to eliminate the use of the calf!

  ii) the totality of the pressure on the pedal comes uniquely from the thigh (5).

- with respect to Fig 43, the situation is absolutely similar but reversed:

  i) the anterior tibial muscle (23) is useless for increasing the upward traction on the pedal and, therefore, energy is wasted.

ii) the totality of the upward traction on the pedal comes uniquely from the iliopsoas(22). We will not demonstrate the proof in the case of Fig 43 since this proof was already made in the first part of this document, but in reverse (that of the calf, Fig 42); a bit of reflection will help you understand that Fig 42 and 43 represent exactly the same phenomenon, but reversed.

If we were to redo the same reversed demonstration with Fig 43, we would be talking of the optical illusion of the anterior tibial muscle (23) instead of the optical illusion of the calf etc... Remaking such a demonstration would be useless and would take much too long.

Please note: the distance ratio A/D=3 of Fig 43 is the same as the distance ratio A/B of Fig 42, meaning that the anterior tibial muscle (23) wastes half (approximately) of the total energy during the ascending phase, as the calf (4) of Fig 42 wastes half (approximately) of the total energy during the descending phase.

In the case of Fig 42, the platform which supports the heel is the solution to eliminate the waste of energy by the calf. We will see later that a miracle will take place: we will demonstrate that it is possible, by a slight modification to the platform, to eliminate the use of the anterior tibial muscle, thus doubling the energy efficiency of the ascending phase and, at the same time, doubling the available power since both legs work at the same time.

Before proceeding to the technical explanation, we must point this out: the MAXIMUM tension that the anterior tibial muscle (23) can support is VERY SMALL compared to that of the calf.

The calf can easily support three times your weight (thus, hundreds of pounds) while the anterior tibial muscle has much difficulty in supporting a tension of 30 to 40 lbs; to convince yourself, try and lift a weight of 40 lbs with the tip of your foot: extremely difficult. A very interesting conclusion follows:

The iliopsoas (22), the muscle which lifts the thigh, is very powerful. However, the fact that anterior tibial muscle (23) can only support a small maximum tension (let's say 30 lbs) brings a limit to the maximum upward force that the iliopsoas (22) can exercise! It is clear that the use of the anterior tibial muscle (as in the case of the strap in Fig 40) PREVENTS the FULL POWER of the iliopsoas (22) FROM BEING USED and this is in addition to the waste of energy created by the use of the anterior tibial muscle (23) itself!

IT IS IMPORTANT TO UNDERSTAND THIS: in the case of Fig 42, if the downward push by the thigh (5) is 100 lbs, the calf must support a tension of 300 lbs which it can do. In the case of Fig 43, if the anterior tibial muscle (23) can support a maximum of 30 lbs, this limits to 10 lbs the tension that the iliopsoas (22) can exercise, which is insignificant: the iliopsoas could apply a tension of several hundred pounds if there was no limitation imposed by the use of the anterior tibial muscle (23). And this is exactly what the modifications to our platform will accomplish: eliminate the use of the anterior tibial muscle, thus allowing us to use the iliopsoas to its maximum potential.

Thus, the modifications to our platform, which we will explain shortly, will allow:

1- the doubling of the energy efficiency of the ascending phase, by eliminating the use of the anterior tibial muscle (23),

2- the use of the iliopsoas (22) to its maximum potential, since the use of the anterior tibial muscle has been eliminated (that was not the case with the strap of Fig 40).

Since A/B=3 in Fig 42, the calf (4) contraction must be equal to three times the downward pressure applied by the thigh (5): as we have demonstrated, it is the intensity of the downward push of the thigh which determines the intensity of the calf contraction and not the opposite. In the case of Fig 43, the situation is similar but reversed: if the upward traction exercised by the iliopsoas (22) is 10 lbs, the anterior tibial muscle must support a tension of three times that amount, i.e. 30 lbs; it is the intensity of the upward traction exercised by the iliopsoas (22) which determines the intensity of the tension supported by the anterior tibial muscle (23) and not the opposite, with this difference that if the maximum that the anterior tibial muscle can support is 30 lbs, this limits to 10 lbs the upward traction which can be exercised by the iliopsoas !

THIS IS FABULOUS:

If we consider the whole pedalling cycle, that is the descending and ascending phases, we have:

a) descending phase: the energy efficiency is doubled thanks to the elimination of the use of the calf; in addition, the platform brings added safety since the foot can hardly slip, and an aesthetic aspect by eliminating large calves for the ladies!

b) ascending phase: the energy efficiency is also doubled thanks to the elimination of the use of the anterior tibial muscle; in addition, the iliopsoas can be used at full power thus reducing the waistline!

Using the two legs simultaneously allows the doubling of the available power in addition to doubling the energy efficiency (energy savings) for the two cycling phases, in addition to double the power!

What more can one ask? Now we will explain the modification to the platform in order to eliminate the use of the anterior tibial muscle (23). IT IS EXTREMELY SIMPLE!

See Fig 44, 45 and 46. First we must point out that the rear of the platform (21) follows a predetermined trajectory in space, this trajectory being defined by the mechanism (s) (there are several possible mechanisms) which support(s) the rear of the platform; there are also mechanisms where the platform is supported and guided from the front. In Fig 44, no mechanism is shown to simplify the drawing. The right foot is illustrated.

On the platform (21) of Fig 44, two elements have been added:

1- a small rod (26) is horizontally attached on the side of the platform, this rod is removable by the cyclist if he does not want to use the special footwear which is required. This footwear, as shown in Fig 45, is fitted with a hole in the heel (27), the hole entrance is in a funnel shape to facilitate the rod (26) insertion without having to look (a skill that can easily be acquired with a little practice). The foot cut-out (Fig 46) shows clearly that the ankle (1) axis of rotation must be in the same line of action as that of the rod axis (26), that is to say, vertical with respect to the platform surface (the 90□ angle shown); it is evident that, in this case, the contraction effort required from the anterior tibial muscle (23) is (nearly) eliminated during the ascending phase, when the iliopsoas (22) pulls the platform! If we use this rod (26) in combination with the special footwear (28) equipped with a hole (27) where the rod is inserted, then, in this case, element 25 is not required.

2- This element (25) can be removed if the cyclist only wishes to use the rod (26) and the special footwear (28). This element (25) is attached to the side of the platform (21), and covers the junction of the foot and the leg as shown; it is well padded for comfort and maintains the whole foot in contact with the platform (21), thus avoiding the contraction of the anterior tibial muscle (23) during th e ascending phase when the iliopsoas (22) pulls the platform (21) upwards. Note that element (25) covers only the left side and the top of the right foot (near the leg): the right side is open, permitting the easy insertion of the foot, without looking (after a bit of practice), and the foot is always correctly positioned, automatically!

FOR A LONG DISTANCE on flat terrain, the average force exercised by the iliopsoas is small; therefore, the cyclist can enjoy the use of these two mechanisms all in comfort!!!

DESCRIPTION OF MECHANISMS

The series of mechanisms that we will now describe are quite different from one another, but they all accomplish the same functions, i.e:

eliminate the use of the calf (4, Fig. 42)

and/or

eliminate the use of the anterior tibial muscle (23, Fig. 43), thus allowing the maximal use of the iliopsoas (22, Fig.43)

Let us begin by noting that our mechanisms will ignore the horizontal component of the force on the pedal and will only consider the vertical component. With respect to Fig. 47 & 48, the calf and the anterior tibial muscle are not shown, since the totality of the force on the pedal can only come from the thigh. Fig. 47 shows the first part (angle $\omega 1$) of the descending phase, when the pedal goes from the top neutral position to the horizontal position of the crank. The resulting force F1 on the pedal comes from forces f1 and f2: the horizontal force f1 comes the contraction of the quadriceps (QA), and the vertical force f2 comes from the contraction of the gluteal (5). Ideally, if the cyclist makes perfect use of his/her muscles,

- the vertical component f2 should be NIL at the top neutral position, and increase gradually to reach a maximum when the crank is horizontal,
- the horizontal component f1 should be at its maximum at the top neutral position and diminish gradually to NIL when the crank is horizontal.

Similarly, in the second part of the descending phase (angle $\omega 2$), the gluteal (5) plays the same role as in the first part, that is to create the vertical force f2. However, the pedal is pushed to the rear (f3) by the contraction of the bend of the knee (JA); the combined action of f2 and f3 results in force F2 on the pedal.

Ideally, if the cyclist makes perfect use of his/her muscles, during this second part of the cycle, then

- the vertical component f2 should reach its maximum when the crank is horizontal and diminish to NIL when the crank reaches the bottom neutral position,
- the horizontal component f3 should be NIL when the crank is horizontal and should gradually increase in intensity to a maximum when the crank reaches the bottom neutral position.

Please note that all these forces (f1, f2 and f3 which result in forces F1 and F2) originate from the thigh only.

Our invention does not modify the use of the thigh muscles: consequently, we do not need to concern ourselves with the forces applied to the pedal by the thigh; the only aspect that will be considered in the description of the mechanisms to follow consists of the effect of the elimination of the use of the calf and/or the anterior tibial muscle (this effect being mainly vertical, since the calf pushes the tip of the foot downward and the anterior tibial muscle pulls the tip of the foot upwards).

However, in the case of the mechanism involved with the vertical crankset, we will need to account for the horizontal forces f1 and f3, but this is the only exception: for all other mechanisms, we will ignore horizontal forces f1 and f3. Of all our mechanisms, only the vertical foot displacement mechanism modifies the use of the motor muscles (of the thigh), by eliminating the use of the bend of the knee (JA) and the quadriceps (QA).

Using Fig. 44 we already explained the two methods of eliminating the use of the anterior tibial muscle (23, Fig. 43) thanks to element 26 and/or element 25 which maintain the foot in contact with the platform (21), therefore only the iliopsoas (22, Fig.43) is used to pull the platform upwards when the foot completes the ascending phase of the pedalling cycle.

We will now explain other possible concepts. Please note two important points.

First, the mechanisms shown are far from being technically perfect; the technical concept has been limited to the strict minimum in order not to burden the drawings with useless details: instead consider the mechanisms as illustrations of general principles (the technical concepts for a given general principle could be infinite).

Second, a fundamental point: the importance of this document does not stem from the mechanisms; the corner stone which supports this document comes from the proofs (experimental and theoretical) that the calf contraction cannot increase the pressure on the pedal and, inversely, that the contraction of the anterior tibial muscle cannot increase the upward pull on the pedal (with the tip of the foot strapped to the pedal), during the descending and ascending phases of the pedalling cycle.

That is the essence of this document, and not the mechanisms; the mechanisms are just the means to effectively utilize this scientific discovery (the uselessness of the calf and the anterior tibial muscle when pedalling); if someone is not aware of this scientific discovery, then, in his/her eyes, these mechanisms will appear useless!

It is this scientific discovery which gives scientifically proven value to the mechanisms, and the reverse: the mechanisms shown have a great economic value uniquely because of the scientific discovery on the uselessness of the calf and the anterior tibial muscle (for the use of pedals).

Here are other possible general concepts.

Fig. 49 represents a simple apparatus which allows the elimination of the use of the anterior tibial muscle (23, Fig. 40) when the iliopsoas (22, Fig.40) pulls the pedal upwards, thanks to the strap (24, Fig. 40) which attaches the tip of the foot to the pedal.

The apparatus shown in Fig. 49 is made up of a non-stretch rope (29) one extremity of which is attached to a ring (30) which is secured to the top front of the shoe, this rope (29) separating into two parts the extremities of which are attached to two other rings (30) located on each side of the knee articulation; from these two rings leave 3 leather straps, two of them (31,32) located on top of the knee and the third (33) behind the knee as shown in Fig. 49; it is evident that when the thigh pulls the pedal upwards, it is this rope (29) which supports the tension instead of the anterior tibial muscle, thus the energy savings.

Fig. 50 shows the same apparatus except that the rope (29) is attached to a ring (30) AT THE REAR of the shoe; the evident purpose being that this rope (29) allows the support of the tension that would normally be supported by the calf: THE ROPE REPLACES THE CALF, hence, the energy savings.

It goes without saying that the use of this apparatus would require a special shoe to which the ring (30) would be firmly attached to the front and/or the rear of the shoe.

One can also doubt of the commercial value of such an apparatus, people would find it rather clumsy! Here, this example of a simple apparatus was given just to demonstrate that it is POSSIBLE (in theory) to reduce the energy consumption CONSIDERABLY with only a PIECE OF ROPE (Fig 51 shows the isolated apparatus)!

The next concept (Fig 53) looks like some sort of a "plaster boot", the kind that one wears to heal a fracture (and that everyone are rushing to autograph!). This concept consists of a VERY RIGID boot, in two sections (34 and 35) attached by rotating joints (36), and which allows, by closing onto the foot and the lower leg (Fig 52), to "solder" the heel (1) such that the latter can no longer fulfill its role, i.e. it is no longer possible to MOVE the foot; it is evident that this "boot" prevents (in theory) the calf from contracting during the descending phase and also prevents the contraction of the anterior tibial muscle during the ascending phase if a strap (24) is used. Evidently, one might doubt of the commercial potential of this ankle boot, as is the case for the "rope" apparatus described earlier!

The objective of discussing this ankle boot concept is simply to demonstrate that it is POSSIBLE (at least in theory) to reduce the energy consumption CONSIDERABLY (and to double the available power by using the two legs simultaneously) by using VERY SIMPLE concepts (however clumsy). such as a "piece of rope" and a rigid ankle boot!

See Fig. 54; one might think that it is possible to avoid the contraction of the calf (4) by placing the foot on the pedal (15) in such a way that the heel joint (1) is located exactly ABOVE (at a distance of +di) the pedal axis (15) (the 90° angle); the problem here is that is position of the foot rapidly becomes sore (the arch of the foot is very sensitive) and, ESPECIALLY, this is a position exhibiting an INSTABLE equilibrium!

Indeed, if one DOES NOT use the calf (4) nor the anterior tibial muscle (23), a SMALL displacement of the heel (1) to the left of the pedal axis (15) will force the tip of the foot towards the ground, the 90° angle no longer being maintained, thus forcing the anterior tibial muscle (23) to contract in order to straighten the foot; the same goes if the heel moves SLIGHTLY to the right of the pedal axis (15): the heel is directed towards the ground, thus forcing the calf (4) to contract to straighten the foot.

The EXISTANCE of distance (+di) CAUSES the INSTABLE equilibrium, this distance (+di) being the vertical distance between the heel axis (1) and the pedal axis (15); the + sign in front of the symbol di (+di) simply means that the heel axis (1) is ABOVE the pedal axis (15), and that is precisely what CAUSES the UNSTABLE equilibrium. Is it possible, for the descending phase, to eliminate these two problems, i.e.:

- NOT TO use the arch of the foot (as is the case in Fig. 54), which is SORE to do,

- obtain a STABLE equilibrium (+di equal to ZERO)? The answer is YES. With regards to problem no 1, it suffices to use a platform (21) which supports the WHOLE foot, as shown in Fig 55. For problem no 2, it is possible to obtain a STABLE equilibrium by positioning the platform (21) such that:

a) the heel's axis of rotation (1) is situated exactly UNDER the axis of rotation (15, where the pedal was, before being replaced by the platform); here, distance di is NEGATIVE (-di), thus allowing a STABLE equilibrium (but ONLY for the descending phase, when the thigh pushes DOWNWARD): it is because the heel (1) is located UNDER the axis of rotation (15) that we have a STABLE equilibrium (compared to the situation in Fig 54 which was UNSTABLE - since the distance di was positive (+di)).

b) the WEIGHT of the platform to the LEFT of reference (15) should be the same as the WEIGHT of the platform to the RIGHT of reference (15), in order that the platform can REMAIN horizontal, by gravity.

Evidently, with this design, the platform is not guided: it can rotate FREELY around the axis of rotation (15) and is maintained in place by gravity; the platform is held in place at the rear by part (37) and at the front by part (38); parts 37 and 38 are joined to the platform (21) and meet at the axis of rotation (15). It is difficult to tell right now whether such FREE movement of the platform is advantageous or not: only experimentation could answer that question.

Furthermore, with such a concept, one might ask a few questions such as "is there a danger that the tip of the foot strikes the ground?" (this problem could be solved by designing a bicycle with an elevated crankset, or in using shorter cranks) or another question such as "does this concept totally eliminate the contraction of the calf or only partially?"

But, one thing is certain: this concept, AS ILLUSTRATED BY FIG 55, DOES NOT ALLOW the efficient use of the ascending phase (when the foot goes up from the rear, using part 26 of Fig 44 and using a special shoe (28) with a hole (27) in the heel - Fig 45); indeed, with a bit of reflection one can understand that, during the ascending phase, there is an UNSTABLE equilibrium if part 26 inserted in the hole (27) of the shoe (Fig 55) is situated UNDER the axis of rotation (15) when the iliopsoas pulls the thigh UPWARD; to obtain a STABLE equilibrium during the ascending phase, the axis (26) must be located ABOVE the axis of rotation (15) when the thigh pulls upwards.

The next concept is simply an IMPROVEMENT of the mechanism which we just described (Fig 55): this improvement allows the efficient use of the ascending phase, by eliminating the use of the anterior tibial muscle, thus allowing to use the iliopsoas to its full potential.

Fig 56 to 60 illustrate the same mechanism, Fig 56 during the ascending phase and Fig 59 during the descending phase.

Fig 56: the triangular part (37,38) is attached to the side of the platform (21); at the top of this triangle is attached an L-shaped rod (40), the vertical portion of this L-shaped part sliding inside a spring with a weak compression (41) and the horizontal portion of this L-shaped rod being inserted in the hole (27) of the shoe's heel (see Fig 44,45).

The vertical portion of part 40 slides inside part 39's hole which is attached to the extremity of the crank where was the pedal which has been removed (15) (Fig 58 shows part 39 isolated). The operation is elementary:

- during the ascending phase (Fig 56), the spring IS NOT compressed thus the axis of the horizontal part 40 COINCIDES EXACTLY with the axis of rotation of the crank's extremity (15) in which the axis of part 39 is inserted; therefore there is a STABLE equilibrium and the iliopsoas (which pulls the thigh upwards) can be utilized to its full potential since the STABLE equilibrium thus obtained allows the elimination of the use of the anterior tibial muscle (if the horizontal axis of part 40 was situated UNDER the axis of the ex-pedal 15, the equilibrium would be UNSTABLE, thus requiring some contraction of the anterior tibial muscle and/or of the calf to maintain the foot in the required position since the upward traction of the iliopsoas would have a tendency to DISPLACE the axis 40 to the left or right of axis 15, because of the UNSTABLE equilibrium;

- during the descending phase (Fig 59), the spring (41) is totally compressed (having a weak resistance) as soon as the thigh begins its downward push.

See Fig 60: we see clearly that the HEEL' s (1) axis of rotation is located UNDER the axis of rotation of the crank's extremity (15), thus yielding a STABLE equilibrium for this descending phase, and ELIMINATING THE USE OF CALF since the heel's (1) axis is ALWAYS maintained exactly UNDER axis 15 BY the downward pressure ITSELF (if the heel's (1) axis was ABOVE axis (15) during the descending phase, then the DOWNWARD pressure from the thigh would tend to cause axis 1 to deviate to the left or the right of axis 15, thus requiring the contraction of the anterior tibial muscle or the calf to bring the foot back to the required position, as explained clearly by Fig 54).

The mechanism that we just described explains a GENERAL concept only, the technology illustrated being rather elementary. Our intention here is to illustrate concepts of a GENERAL nature and to keep the TECHNOLOGY to its simplest expression, in order not to needlessly complicate the drawings (as you know, the technology ITSELF can be improved nearly INDEFINITELY, for a given general concept: it is best to keep to PRINCIPLES and forget the TECHNOLOGY!).

The next concept involves a VERTICAL displacement of the foot, in other words the foot moves down vertically and follows EXACTLY THE SAME trajectory on the way up, in contrast to the usual circular crankset where the trajectory of the foot in its upward movement from the rear (the ascending phase) is evidently NOT THE SAME as the downward trajectory (the descending phase). Again, the TECHNOLOGY will be limited to its simplest expression.

IMPORTANT: we ask that you make a special effort of concentration on what will follow since the discussion of the VERTICAL crankset (versus the usual CIRCULAR pedal) may be a fundamental key which will help CHOOSE the final concept for commercialization.

In the following explanation, we will consider that

a) the use of the CALF has been eliminated thanks to the use a PLATFORM in lieu of a PEDAL,
b) the use of the ANTERIOR TIBIAL MUSCLE has been eliminated thanks to the concept of Fig 44, by using parts 25 and/or 26, thus using the ILIOPSOAS (the muscle that pulls the leg upward) to its full power.

Therefore, we will assume that the TWO pedalling cycles, i.e. the descending and ascending phases, are used efficiently in the following explanation; we shall no longer need to be concerned with the CALF and the ANTERIOR TIBIAL MUSCLE since our discussion will involve the PROPULSIVE muscles ONLY, i.e. those of the thigh (there are several, but we will concern ourselves with the 4 main ones, i.e. the GLUTEAL, the QUADRICEPS, the BEND of the KNEE and the ILIOPSOAS).

Fig 61 illustrates the 4 propulsive muscles of the thigh that will be studied, i.e. the GLUTEAL (5) which pushes the thigh DOWNWARD, the ILIOPSOAS (22) only viewed partially and which is used to LIFT the thigh (see Fig 40 for a better view of the iliopsoas, which is in two parts), the QUADRICEPS (QA) which pushes the foot FORWARD (i.e. the leg extensor), and the BEND of the KNEE (JA) which pushes the foot toward the REAR (i.e. the leg flexor). Fig 62 is a enlargement of the knee, and Fig 63 visually illustrates how the QUADRICEPS, by contracting, ROTATES the leg bone (11) around the knee joint (13), thus pushing the foot forward, and how the BEND of the KNEE does the same but towards the rear.

Since we IGNORE the calf and the anterior tibial muscle to SIMPLIFY things, these muscles are NOT shown on the 4 drawings 64, 65, 66 and 67, and the FOOT no longer need to be shown: on these 4 drawings, we consider that the heel (1) coincides with the axis of rotation of the pedal (15) (where it was before removal).

(Here, we have a problem with the vocabulary: the word CRANKSET implies the use of PEDALS by definition; however, we have yet to baptize this "thing" consisting of a PLATFORM moving in circle at the end of a crank (the word PLATFORM seems ridiculous); therefore, for the lack of a better term, we will use the term CRANKSET to identify it, even though the pedals have been replaced by the platforms).

What will be studied here is the EFFECT on the USE of PROPULSIVE muscles of the THIGH (gluteal, quadriceps, bend of the knee and iliopsoas) caused by a MODIFICATION of the trajectory followed by the heel, going from a CIRCULAR trajectory (the usual crankset) to a VERTICAL trajectory (the new concept that we will introduce).

To achieve this, we will take into account an IMPORTANT CHARACTERISTIC pertaining to muscles, i.e. to SPEND energy even if this expenditure is NOT accompanied by effectively PRODUCED mechanical WORK, i.e. a DISPLACEMENT in the DIRECTION of the force (in the Newtonian sense, WORK is the product of a FORCE by the displacement in the direction of that force); for example, if you press hard on a table top with your hand, HEAT is produced (your muscles heat up as does the table top), but there is no mechanical WORK produced since the table does not move. What interests us most is that the bicycle MOVES, thus implying that the crankset must TURN; FOR US therefore, any muscular energy expenditure not accompanies by a DISPLACEMENT of the crank is a pure waste of energy.

Therefore, if by studying the 4 drawings 64, 65, 66 and 67, we discover situations where certain muscles spend energy WITHOUT PRODUCING A DISPLACEMENT, and if we can ELIMINATE these situations by going from a CIRCULAR trajectory to a VERTICAL trajectory, then we INCREASE THE ENERGY EFFICIENCY of the motor; and this is perfectly in accordance with the UNIVERSAL LAW OF THE CRANKSET (section 7, chapter 8) which states (among other things) "...a MODIFICATION to a crankset - here, going from circular to vertical - to bring a REAL improvement, must MODIFY THE USE of the MOTOR muscles ..... by INCREASING the ENERGY EFFICIENCY of the muscles CURRENTLY being used ....".

On the 4 drawings 64, 65, 66 and 67, ONLY those muscles which are EFFECTIVELY used are illustrated, for each of the 4 portions (of 90 degree each) of the complete cycle (here, remember that we are using platforms with parts 25 and/or 26 of Fig 44, allowing us to eliminate the use of the calf and the anterior tibial muscle make the complete cycle efficient, INCLUDING the ascending phase).

Fig 64 illustrates the first 90 degree of the cycle, when axis 15 (where the pedal used to be) goes from the neutral position at the top to the horizontal position of the crank. The QUADRICEPS (QA), by contracting, rotates the leg bone (11) around the knee joint (13), thus pushing the foot forward and produces the HORIZONTAL force f1. At the same time, the GLUTEAL (5). by contracting, pushes the thigh bone (6) downward, thus producing the VERTICAL force f2.

The force F1 is the RESULTING force (of components f1 and f2). PLEASE, PAY SPECIAL ATTENTION TO WHAT FOLLOWS.

Let's study this first 90 degree angle carefully and let's consider the STARTING position, i.e. the crank in a VERTICAL position (the top neutral position): in that position, the VERTICAL force f2, IF IT IS PRODUCED, is NOT USEFUL since its line of action goes through the center of the crankset: this force cannot produce a lever effect; therefore, IDEALLY, at the NEUTRAL POINT AT THE TOP, the cyclist SHOULD NOT attempt to push downward with the GLUTEAL (5) because this would be wasted energy since the resulting force f2 could not produce a DISPLACEMENT.

IDEALLY, i.e. when the cyclist is in PERFECT control of his/her muscles, that cyclist SHOULD be able to apply the force of the GLUTEAL (5)'s contraction ranging from a value of ZERO at the neutral point at the top up to a MAXIMUM when the crank is horizontal: therefore, a GRADUAL increase of the gluteal's (5) force of contraction as the foot moves downward, starting from ZERO at the top neutral point.

Always IDEALLY, the perfect cyclist SHOULD contract the QUADRICEPS (QA) to the maximum when the crank is VERTICAL (at the starting point) since, in that position, the lever effect of the QUADRICEPS is at maximum because the line of action of the HORIZONTAL force f1 (produced by the quadriceps) is PERPENDICULAR to the crank, thus producing a DISPLACEMENT of the latter and, therefore, the energy from the contraction of the quadriceps is USEFUL. Therefore, IDEALLY, the QUADRICEPS' force of contraction should be at its MAXIMUM at the top neutral point and DIMINISH GRADUALLY as the foot moves downward to a value of ZERO when the crank becomes horizontal.

Let's resume, IDEALLY:

a) the GLUTEAL (5) should have a force of contraction of ZERO at the top neutral point (crank is vertical) and reach GRADUALLY a MAXIMUM value when the crank is horizontal;
b) in the meantime, the QUADRICEPS (QA) should do THE OPPOSITE of the GLUTEAL, i.e. apply a MAXIMUM contraction force at the top neutral point (crank is vertical) and diminish GRADUALLY in intensity to a value of ZERO when the crank is horizontal.

These two IDEAL situations are illustrated by Fig 68 and 69, where ONLY the muscles that SHOULD be used are shown. This is the IDEAL, PERFECTION, supposing that the cyclist CONTROLS PERFECTLY the use of his body's muscles!

To achieve this, the cyclist's mind must be CAPABLE, at the top neutral position, to command the gluteal NOT TO contract, and, AT THE SAME TIME, command the quadriceps to contract at maximum; afterwards, the cyclist's mind must order the quadriceps to GRADUALLY REDUCE the contraction as the foot goes down and, AT THE SAME TIME, order the gluteal to gradually INCREASE its contraction as the foot goes down. THE HUMAN MIND IS INCAPABLE TO ACCOMPLISH SUCH AS FEAT: we would have to replace the human by a computer!

The PRACTICAL conclusion is as follows:

i) people (even racers to a lesser extent) PUSH DOWNWARDS with the GLUTEAL when the crank is at the top neutral position (AT THE VERTICAL), representing a WASTE OF ENERGY since there is no DISPLACEMENT of the crank (no mechanical WORK),

ii) similarly, when the crank is HORIZONTAL, people (even racers to a lesser extent) CONTINUE pushing the foot FORWARD by contracting the QUADRICEPS: this is also a PURE WASTE OF ENERGY since there is no DISPLACEMENT of the crank.

THAT IS THE REALITY. However, the good news is that the simple concept of the crankset with VERTICAL displacement, which will be explained shortly, ELIMINATES this waste of energy!

Fig 65 shows the muscles used during the 2nd 90 degree angle (w2) when the crank goes from the horizontal to the vertical position, at the bottom neutral position.

The gluteal (5), by contracting, produces the HORIZONTAL force f3 directed towards the rear. IDEALLY, if the cyclist is in perfect control of his/her muscles:

a) f2 (produced by the gluteal (5) should be at its maximum when the crank is horizontal, and should diminish gradually in intensity to ZERO at the bottom neutral point.

b) inversely, f3 (produced by the BEND of the KNEE (JA) should be ZERO when the crank is horizontal and increase gradually in intensity to a MAXIMUM at the lower neutral point.

This IDEAL is illustrated by Fig 69 and 70.

That is the IDEAL; in reality, cyclists continue to contract the BEND of the KNEE when the crank is horizontal and continue to push downward with the gluteal when the crank is at the bottom neutral point: this is a WASTE of energy since there is NO DISPLACEMENT of the crank! The VERTICAL crankset eliminates this waste of energy!

Fig 66 illustrates the 3rd 90 degree angle (w3). Here the ILIOPSOAS (22) produces VERTICAL force f4 directed UPWARDS, and the BEND of the KNEE (JA) produces HORIZONTAL force f3 directed to the rear, force F3 being the RESULTANT of components f3 and f4.

IDEALLY,

a) f4 SHOULD go from ZERO at the bottom neutral point to its MAXIMUM value when the crank is horizontal, and

b) f3 SHOULD, ideally, go from its MAXIMUM value at the bottom neutral point to ZERO when the crank is horizontal. That ideal is represented by Fig 70 and 71.

That is the IDEAL, and you surely know that , in reality, cyclists do NOT use their muscles in that fashion, thus WASTING energy.

Finally, FIG 67 illustrates the 4th 90 degree angle (w4). Force f4 directed upwards is produced by the iliopsoas (22) and horizontal force f1, directed to the front, is produced by the quadriceps (QA). Always IDEALLY,

a) f4 should be MAXIMUM when the crank is horizontal, and should gradually diminish to ZERO at the top neutral point, and

b) f1 should be ZERO when the crank is horizontal and reach its MAXIMUM at the top neutral point

Fig 71 and 68 illustrate this IDEAL in the use of muscles, this ideal being evidently IMPOSSIBLE to attain (at least for a CIRCULAR crankset)! This IDEAL, for a circular crankset, can be summarized as follows:

- Fig 68 (top neutral position): only the quadriceps (QA) is used (adding the other muscles which PUSH THE FOOT FORWARD. if there are any) to produce force f1; in that case, the foot would need to be ATTACHED to the pedal by a strap or something else, what the usual cyclist does not like since this could be cumbersome and dangerous: indeed, one must be able to QUICKLY place the foot on the ground in case of an abrupt stop and the repositioning of the foot to start again (without looking) is difficult.

- Fig 69 (horizontal crank at the front): only the gluteal (5) is used (adding the other muscles which push the thigh DOWNWARD, if there are any) to produce force f2;

- Fig 70 (bottom neutral point): only the bend of the knee (JA) is used (adding the other muscles which push the foot to the REAR, if there are any) to produce force f3: this implies that the foot is somehow attached to the pedal, with all the nuisance that this brings.

- Fig 71 (horizontal crank at the rear): only the iliopsoas muscle (22) is used (adding the other muscles needed to BRING THE THIGH UP, if there are any) to produce force f4. Evidently the foot must be attached to the pedal.

Therefore these 4 drawings represent an IDEAL to be attained in the use of muscles, which is impossible since no cyclist is capable of such a feat in muscular control.

Again, cyclists do NOT use their muscles according to the IDEAL explained, thus causing a great waste of energy (since no DISPLACEMENT occurs), that being the fundamental characteristic of MUSCLES, i.e. sometime spend energy WITHOUT producing a MECHANICAL DISPLACEMENT, thus NOT USEFUL in moving the bicycle FORWARD!

Our VERTICAL crankset will ELIMINATE this energy waste, thus INCREASING the energy efficiency of the whole MOTOR (the thigh ONLY), this is ADDED to the energy savings ALREADY realized thanks to the elimination of the muscles which are NOT part of the MOTOR, i.e. the CALF and the ANTERIOR TIBIAL MUSCLE Through the use of PLATFORMS (in lieu of pedals) and the concept of Fig 44 (parts 25 and 26) which allow the use of the iliopsoas to its full power, thus a potential POWER DOUBLED, the TWO legs being used SIMULTANEOUSLY (descending and ascending phase)! Before describing our VERTICAL displacement mechanism, we must first discuss the notion of LEVER RATIO.

See Fig 68, 69, 70 and 71: the lever ratio of the GLUTEAL (5, Fig 69) is 3, that of the ILIOPSOAS (22, FIG 71) is also 3, that of the QUADRICEPS (QA, Fig 68) is 15 and that of the BEND of the KNEE (JA, Fig 70) is also 15 (the numbers 3 and 15 represent only a APPROXIMATE VISUAL ESTIMATE, but the fact remains that the degree of lever ratio of QA and JA is MUCH greater than the degree of lever ratio of the gluteal and of the iliopsoas).

Fig 69: arrow F5 illustrates both the INTENSITY and the DIRECTION of the contraction force of the gluteal (5); this force F5 has two components:

- the HORIZONTAL force (fh) which is a hip compression force,

- the VERTICAL force (f2) which pushes on the pedal: VISUALLY, this force is approximately ONE THIRD of the intensity of F5; we therefore state that the LEVER RATIO of the gluteal (5) is 3; in other words, to OBTAIN a force f2 of 1 lb, F5 must be 3 lbs.

Fig 71: for similar reasons, we state that the LEVER RATIO of the iliopsoas (22) is also 3.

Fig 68: the quadriceps (QA), by contracting, rotates the leg bone (11) around the knee's point of rotation (13), thus creating force pushing the foot forward (f1); as the ratio of distances D11/dq is approximately 15, the force of contraction of the quadriceps (fq) must be 15 TIMES the force f1 which we wish to obtain: if we desire to obtain an intensity of 1 lb for f1, fq must be 15 lbs; meaning that the LEVER RATIO of the quadriceps is approximately 15.

Fig 70: for similar reasons, we state that the LEVER RATIO of the bend of the knee (JA) is also 15 since the ratio of distances D11/dj is also 15.

See Fig 62, 63 and 70:

- D11 is the distance between the heel's point of rotation (1) and the knee's point of rotation,
- dq is the distance between point (13) and the point of attachment (Q) of the quadriceps' tendon (QA) to the knee,
- dj is the distance between point (13) and the point of attachment (J) of the hamstring (JA) on the leg bone.

THIS IS VERY IMPORTANT: experimentation has demonstrated that the TOTAL energy spent by a muscle is made of two parts:

a) a part which depends on the TENSION supported by the muscle, with no consideration for the amount of muscle contraction (its shortening),

b) a part which depends on the SHORTENING of the muscle, i.e. the amount of MECHANICAL WORK (displacement) that it produces.

Part a) is BY FAR the most important; for all practical purposes, we can state that the amount of energy spent by a muscle is proportional to the TENSION it supports, regardless of its degree of shortening (the displacement); and a bit of reasoning will easily let you understand this: if we have a certain amount of energy to spend, it is best to MAXIMIZE the use of muscles with a low LEVER ACTION (the gluteal (5) and the iliopsoas (22) which have a lever ratio of three), and MINIMIZE the use of muscles which have a high LEVER RATIO (the quadriceps (QA) and the bend of the knee (JA) which have a lever ratio of 15). By doing this, we increase the ENERGY EFFICIENCY of the motor! The VERTICAL crankset permits this by MINIMIZING the use of the bend of the knee and of the quadriceps, this energy savings being ADDED to that explained before.

Here is what this crankset with VERTICAL displacement consists of.

The concept that we will explain is one of the simplest that one could imagine and, once again, the goal here is not to seek the perfect technology (which in itself could be perfected at infinitum), but only to explain that it is POSSIBLE to obtain, thanks to the VERTICAL displacement of the foot, a CONTINUOUS movement of ROTATION, i.e. having no NEUTRAL POINTS (as in the case of the CIRCULAR crankset), and utilizing the TWO phases (when the foot goes down and when it goes up). Following the description of the mechanism itself, we will explain again the energy savings.

Fig 72, 73, 74 and 75 illustrate a rudimentary mechanism, driven by one foot only, and which rotates a wheel (49) ALWAYS IN THE SAME DIRECTION, regardless whether the foot goes up or down; fig 72 shows the descending phase (when the foot goes down), fig 73 illustrates fig 72 in the top view, fig 75 shows the ascending phase (when the foot goes up): the ascending phase is active thanks to parts 25 and/or 26 added to the platform, as already illustrated by fig 44.

Fig 74 shows the special platform (21) that is used: the part shown in the shape of Z under the platform is made up of one piece and is integral to the platform, this Z part is inserted in part 42, fig 72. Fig 72: the Z part has 2 springs (r1 and r2), spring r2 is compressed when the foot pushes downward; when the foot goes up (fig 75), spring r2 is released and spring r1 is compressed.

Part 42 goes from the top to bottom when the foot goes down (fig 72) and from the bottom to the top when the foot goes up (fig 75): when the foot goes down, the T-shaped part is pushed to the right in the inclined section of the Z part; the cogs of part 45 engaging the cogs of wheel 46 in the direction shown; wheel 48 equipped with a chain (ch 48) is integral with wheel 46 and rotates with it, thus engaging wheel 49. Part 42 slides up and down 4 rods (t1, t2, t3 and t4) which are attached to base 50 (see fig 73).

Fig 75 illustrates what happens when the foot pulls up thanks to parts 25 and or 26 added to platform (21) according to the concept of fig 44: spring r1 is compressed, spring r2 is released, thus dragging upwards part Z attached to the platform, therefore pushing the T-shaped part (43) TO THE LEFT, coupling with the toothed wheel 44; since part 42 moves UPWARDS along the 4 rids (t1 to t4), wheel 49 is rotated in the direction shown, thus engaging wheel 47 (which is integral with wheel 44), chain (ch 47) engaging wheel 52 (see fig 73), rotating wheel 49 in the direction shown.

Springs r3 and r4 are used to keep parts 43 and 45 in contact with part 42 when they are not engaged with the corresponding wheel (44 or 46).Note this:

- when the foot PUSHES DOWN (fig 72) or PULLS UP (fig 75), the rear wheel 49 (which symbolizes the rear wheel of a bicycle) ALWAYS turns IN THE SAME DIRECTION,

- in the case of a CIRCULAR crankset, there are 2 NEUTRAL POINTS, one at the top and the other at the bottom; at the top neutral point, the contraction of the gluteal is a WASTE of energy since the line of action of the force goes through the center of the crankset, thus producing NO lever effect on the crank. Similarly, at the bottom neutral point, the contraction of the iliopsoas (which pulls the foot upwards) has NO lever effect on the crank. The VERTICAL crankset described here has NO NEUTRAL POINT! Indeed, the LEVER ACTION is ALWAYS MAXIMUM since the DOWNWARD (fig 72) or UPWARD (fig 75) force is ALWAYS PERPENDICULAR (tangent) to wheels 44 and 46. Therefore, the GLUTEAL (for the downward push) and the ILIOPSOAS (for the upward pull) both have perfect ENERGY EFFICIENCY: there is NO LONGER any muscular contraction WITHOUT a mechanical displacement, in contrast with the circular crankset!

- the use of the muscles that move the foot HORIZONTALLY, i.e. the BEND OF THE KNEE and the QUADRICEPS, is eliminated totally, which is excellent since these muscles have a LEVER RATIO of 15; thus the energy saved could be used to set in motion the GLUTEAL and the ILIOPSOAS which have a LEVER RATIO of 3 only, therefore increasing the efficiency (evidently, this is addition to the energy savings already realized by the elimination of the use of the CALF and the ANTERIOR TIBIAL MUSCLE, as explained at the beginning).

This is it for the VERTICAL displacement mechanism. The goal here was not to describe the concept of the PERFECT vertical displacement MECHANISM, i.e. that of the perfect TECHNOLOGY; indeed we could describe almost an infinite number of TECHNOLOGY concepts which would accomplish the same results that we just illustrated. We wanted to simply explain the PRINCIPLE that it is (technically) POSSIBLE to obtain a CONTINUOUS movement of rotation of the wheel (49) always in the SAME DIRECTION, regardless of whether the foot goes up or down, and WITH NO NEUTRAL POINTS.

It appears that the VERTICAL displacement mechanism does not have an immediate future because people LIKE (or are used to) the CIRCULAR crankset. The series of mechanisms that we will now describe make use of the principle of the CIRCULAR movement of the foot, the drawings for these mechanisms being self-explanatory.

Fig 76 illustrates the usual circular crankset, the cyclist pedalling in the fashion recommended by the experts, i.e. the toe joints resting on the pedal axis. Angle θ is the angle of inclination of the bottom of the foot with respect to the ground; we notice that this angle INCREASES CONSIDERABLY when the foot pulls up from behind. The 8 mechanisms that will now be illustrated support the platform and guide it such that this angle θ INCREASES when the foot pulls up from behind, exactly the same as the usual circular crankset; therefore, the user of this invention will not notice ANY DIFFERENCE from the circular crankset, except for one thing: he/she will not longer have to "strain the calf" since the heel is continuously in contact with the rear of the platform, which is supported!

Fig 78 shows the whole mechanism (the 2 feet); fig 79 shows the left foot only; fig 80 illustrates the VARIOUS PARTS of the mechanism of fig 79, and fig 77 shows the MOVEMENT of the various parts during a complete 360 degree turn: we see clearly that angle θ INCREASES as the foot pulls up from behind.

Fig 80: part 57 can move to the desired position inside the slot of part 55, thus making the combined part 57 and 55 is of a variable length; the same goes for parts 58 and 56. Fig 79: parts 55+57 and 58+56 united by the free axis of rotation 61; but the axis of rotation 60 is FIXED: indeed, the axis in the form of a star-shaped hole of part 55 (fig 80) is inserted at the DESIRED POSITION in the star of axis 60, this controlling the angle between part 53 and parts 55+57, and this angle remains constant once chosen.

The goal aimed at by the ADJUSTABLE length of parts 56+58 and 55+57, in addition to the control of the angle between parts 53 and 55-57, is to allow the CHOICE of the angle of inclination of the bottom of the foot with respect to the ground that the cyclist WISHES TO OBTAIN (for comfort) according to his/her height.

One should note that the length of horizontal part 54 is chosen such that part 53 is always PARALLEL to the crank of the crankset; the axis of rotation of the bottom of part 53, i.e. 59, is accomplished thanks to a support attached to the lower frame tube (fig 79).

Fig 81: with this concept, platform 21 is attached at the front to the axis of rotation 15, where the pedal used to be. Part 64 is attached to the lower frame tube and constitutes a free axis of rotation for rod 65 which ties together crank 66 and the toothed cam 67: this cam 67 rotates WITH crank 66; this cam 67 is of the SAME CIRCUMFERENCE than wheel 62 which is INTEGRAL to the crank: wheel 62 and cam 67 have the same number of teeth and are tied by chain 63; the top of the crank 66 is tied to rod 68 by a free point of rotation 69, and the front of rod 68 is attached to the rear of the platform by a free rotation point 70.

The TRACTION TENSION is ALWAYS on the BOTTOM part of the chain: the traction tension on the TOP part of the chain is always ZERO; in the crank position shown, the top part of the chain is not sagging because of the position of cam 67, but for other crank positions, the top part of the chain becomes sagging. The shape of the cam, its position (in relation to part 66), and the length of rod 68 are chosen to obtain an angle of inclination of the foot relative to the ground (the angle , fig. 76) which INCREASES when the foot moves up from the rear.

Fig. 82: platform 21 is attached to the top of the crankset's crank (15) at the front. The rear crank 73 is attached with a free axis of rotation 72 to part 71 which is attached to the lower tube of the frame. The pedal crank and crank 73 are always PARALLEL and attached together at the top thanks to horizontal part 74 and the two free axis of rotation 15 and 75.

IMPORTANT: cam 76 is integral with crank 73 (in fact, 76 and 73 are as a SINGLE PART). A small wheel 77 is attached to the side of the platform, at the rear, and this wheel 77 rotates ON THE CIRCUMFERENCE (the border) of cam 76 when crank 73 moves. The shape of cam 76, its FIXED position (relative to crank 73) are chosen in order to obtain an angle of inclination of the foot relative to the ground (the angle , fig. 76) which INCREASES when the foot moves up from the rear.

Fig. 83: cam 78 is attached to the lower frame tube by support 83: this cam DOES NOT MOVE and has a groove encrusted along its circumference in which runs small wheel 82 when the crankset rotates. Part 79 always moves PARALLEL to the crankset, its free axis of rotation being 80; a small rod 81 elbowed at each end (reversed) goes back and forth inside of the tube which is attached at the top of part 79: part 81 holds the small wheel 82 in the lower elbow, the upper elbow being inserted in the rear of the platform by the free axis of rotation 84. The shape of the groove of cam 78 and its position on the lower frame tube are chosen in order to obtain an angle of inclination of the foot relative to the ground (the angle , fig. 76) which INCREASES when the foot moves up from the rear.

Fig. 84: rod 85 has a FREE axis of rotation 86 located on the axis of rotation of the rear wheel. IMPORTANT: this rod 85 NEVER rotate completely (360 degrees) since it goes back and forth according to angles 1 and 2 relative to the vertical V: its MAXIMUM displacement is therefore 1 + 2.

Rod 87 is attached to the lower frame tube by the free axis of rotation 88: this rod 87 makes a full rotation of 360 degrees with a complete rotation of the crankset. Rod 87 is always PARALLEL to the crankset's crank, but not rod 85. The top of rods 85 and 87 are attached to the elbow part 89 by the free axis of rotation 90 and 91. The third axis of rotation 92 of the elbowed part 89 is attached at the rear of platform 21.

The lengths of rods 85 and 87 together with the shape of elbowed part 89 are chosen in order to obtain an angle of inclination of the foot relative to the ground (the angle , fig. 76) which INCREASES when the foot moves up from the rear.

Fig. 85: part 93 having a groove is attached to the lower frame tube; inside that groove, wheel 94 goes back and forth; to wheel 94 is attached rod 95 the other extremity of which is attached at the rear of platform 21 by the free axis of rotation 99; near the center of this rod 95 is attached rod 96's upper axis of rotation 98, the bottom of this rod 96 being attached to the front of part 93 by the free axis of rotation 97. Rod 96, being always parallel to the crankset's crank, makes a complete 360 degree turn with the crankset rotation. The length of rod 95 together with the location (on rod 95) of axis of rotation 98 are chosen in order to obtain an angle of inclination of the foot relative to the ground (the angle , fig. 76) which INCREASES when the foot moves up from the rear.

Fig. 86: the rigid curved part 100 is attached to platform 21, both being as a single part, the front of the platform being attached to the crank axis, where the pedal used to be located (15). The curved portion at the top of part 100 is inserted BETWEEN two wheels 102 which come to rest on the sides of part 100, these two wheels 102 rotating around two axis w which hold together the 2 parallel and rectangular parts 101; part 101, located between the bicycle's frame tube and the two wheels 102, rotates freely (at its center) around axis z which cuts across the frame tube (at the top left of the drawing, only the right side is illustrated, while at the right of the drawing, both sides are shown, the axis z tying the two sides together). On the other two drawings, it is evident that the angle of inclination of the foot relative to the ground (the angle , fig. 76) which INCREASES when the foot moves up from the rear, that being the goal, according to Fig. 76.

Fig. 87-88: only the left side is illustrated. Wheel 103 is installed in a STATIONARY manner, integral (soldered) of the casing of the crankset axis: this wheel DOES NOT ROTATE, since chain 105 rotates around this wheel when the crankset turns. The SQUARE portion of axle 109 is inserted in the SQUARE hole 109 located at the front of platform 21, part (b) of the same axle being inserted in part (b) of the crank's extremity (which contains ball bearings); part (a) of the same axle is inserted in part (a) of cam 104 and, thanks to the GROOVES of part (a), this axle is INTEGRAL of cam 104; therefore, cam 104, the axle and platform 21 ARE ALL INTEGRAL and are as A SINGLE PART, the grooves of part (a) of the axle allowing to CHOOSE the position of platform 21 RELATIVE to cam 104, thus permitting to CHOOSE the numerical value of angle when the foot moves up from the rear (according to Fig. 76); it is evident that the circumference of cam 104 must be the same as the circumference of STATIONARY wheel 103, both having the same number of teeth.

The pressure on the platform being exerted AT THE REAR by the heel, it is evident that the TENSION (traction) on chain 105 is applied ALWAYS on the LOWER portion of the chain, the tension in the upper portion of chain 105 being always NUL: that's the reason for spring 107 driven chain tensor 106. The SHAPE of cam 104 and its position RELATIVE to platform 21 (controlled by the grooves of part (a) of the axle) yield an increase of angle when the foot moves up from the rear (according to explanations of Fig. 76).

We have used the PARTICULAR CASE of CYCLING to explain the USELESSNESS of the CALF and of the ANTERIOR TIBIAL MUSCLE when we use PEDALS; it is evident that we can apply these results in a UNIVERSAL fashion to EVERYTHING that uses PEDALS (pedal boats, stationary exercise machines, pedal planes! etc...), by replacing these pedals by an appropriate mechanism.

CLAIMS

1- A mechanism CHARACTERISED by permitting, for each lower limb, the near elimination of the use of the calf (4, Fig 42) and/or the anterior leg muscle (23, Fig 43), thus allowing a huge energy savings without the loss of propulsive power DUE TO THE FOLLOWING FUNDAMENTAL DISCOVERY:

an increase in the contraction of the calf cannot increase the pressure on the pedal, the totality of the pressure on the pedal being created only by the contraction of the thigh muscles; similarly, an increase in the contraction of the anterior leg muscle cannot increase the upward traction on the pedal when the foot is brought up from the rear (the foot being attached to the pedal), the totality of the upward traction on the pedal being created solely by the contraction of the thigh muscles; therefore, one must eliminate as much as possible the use of the calf and the anterior leg muscle, by replacing the pedal by an appropriate mechanism, in order to reduce the energy consumption without the loss of propulsive power.

This FUNDAMENTAL DISCOVERY can be explained as follows: (this explanation concerns the calf; the explanation for the anterior leg muscle is the same, but reversed, the anterior leg muscle being the antagonist of the calf: only the explanation for the calf will be given, that of the anterior leg muscle will be easily understood by a scientist normally competent in the field involved)

a) the entire world is convinced that the pressure on the pedal comes from two sources:

i) from the contraction of the thigh,

and

ii) from the contraction of the calf which pulls the heel upwards, thus rotating the foot around the heel (1, Fig 7), thus producing a downward pressure on the pedal.

b) part a) i is true while part a) ii is false, being an optical illusion.

c) this optical illusion can be explained as follows:

i) the force described in a) ii requires a point of support in order to be applied, this point of support cannot be created by the force described in a) i, this force being used to make the heel into a point of support,

ii) at the same time, the world-wide interpretation is that the force described in a) i is also used to push on the pedal.

iii) however, a given force can have only one use; that is the force exerted by the thigh (a, i) is used:

1) to push on the pedal

OR

2) to make the heel into a point of support.

iv) part iii-1 is true and part iii-2 is false due to the second optical illusion which consists in NOT visualizing the force M' (Fig 22).

d) The forces M and M' (Fig 22) cancelling each other, it becomes evident that the contraction of the calf cannot increase the pressure on the pedal, and consequently, the totality of the pressure on the pedal can only come from the thigh muscles, this constitutes the FUNDAMENTAL DISCOVERY mentioned at the beginning.

2- A mechanism according to claim 1, CHARACTERISED by the following components:

a) a ring (30, Fig 50) attached at the rear of the shoe,

b) a non-stretch rope (29) attached at the lower end to a ring secured at the rear of the shoe, this rope separating into two parts at the level of the calf, each upper extremities of this rope being respectively secured to two other rings (30) located on either side of the knee joint,

c) three leather straps tying together the two rings located on either side of the knee joint, two straps (31, 32) located on top of the knee, at the top and the bottom of the joint, and the third strap (33) being located behind the knee, in the joint cavity,

this mechanism eliminating the use of the calf.

3- A mechanism according to claim 1, CHARACTERISED by the following components:

a) a ring (30, Fig 49) attached at the front of the shoe,

b) a non-stretch rope (29) attached at the lower end to a ring (30) secured at the front of the shoe, this rope separating into two parts on each side of the leg, each upper extremities of this rope being respectively secured to two other rings (30) located on either side of the knee joint,

c) three leather straps tying together the two rings located on either side of the knee joint, two straps (31, 32) located on top of the knee, at the top and the bottom of the joint, and the third strap (33) being located behind the knee, in the joint cavity,

this mechanism eliminating the use of the anterior tibial muscle when the foot pulls the pedal upwards, at the condition that the foot is attached to the pedal by a strap (24).

4- A mechanism according to claim 1, CHARACTERISED by the following components:

a) a form (34, fig 53) made of a rigid material which moulds the shape of the foot and of the bottom of the leg (excluding the tip of the foot which rests on the pedal),

b) another form (35, fig 53) made of a rigid material which moulds the shape of the foot and of the bottom of the leg (excluding the tip of the foot which rests on the pedal),

c) the forms described in a) and b) being tied by two rotation joints (36), the first one at the top of the part and the second at the heel level,

d) the forms described in a) and b) closing perfectly on the foot and the bottom of the leg (fig 52), the said mechanism totally preventing the rotation of the heel articulation (1, fig 52), thus allowing:

i) the elimination of the use of the calf during the descending phase,

ii) the elimination of the use of the anterior tibial muscle during the ascending phase (when the foot goes up from the rear), at the condition that the foot is attached to the pedal by a strap (24, fig 52).

5- A mechanism according to claim 1, CHARACTERISED by the following components:

a) a rigid triangle a side of which (37, fig 56) is attached to the rear of the platform (21) and on its side, the other side (38) of the rigid triangle being attached at the center of the platform (21) and on its side,

b) an L-shaped rigid rod (40) the vertical part of which is attached at the center of the triangle, at its extremity,

c) the vertical portion of the L-shaped rod (40) sliding in the hole of part (39, fig 58), this part (39) rotating freely in the axis (15) at the extremity of the crankset's crank, where the pedal was prior being removed,

d) a weak compression spring (41, fig 56) located along the vertical portion of the L-shaped rod (40),

e) the horizontal portion of the L-shaped rod (40) being inserted in the hole (27, fig 45) located in the heel of the special shoe (28, fig 45),

the said mechanism functioning as follows:

i) during the descending phase (fig 59), the vertical portion of the L-shaped rigid rod (40) goes down the hole of part (39), spring (41) being compressed, thus placing the axis of rotation of the heel (1, fig 60) UNDER the axis of rotation (15, where the removed pedal was located), thus creating a STABLE equilibrium, and avoiding the contraction of the calf during this descending phase,

ii) during the ascending phase (fig 56), the vertical portion of the L-shaped rod (40) goes up the hole of part (39), spring (41) being released, thus resulting in the axis of the horizontal portion of part (40) located in the hole (27) of the shoe's heel COINCIDE EXACTLY with the axis of rotation (15, fig 56 and 57), creating a STABLE equilibrium, thus avoiding the contraction of the anterior tibial muscle during this ascending phase.

6- A mechanism according to claim 1, CHARACTERISED by the following components:

a) a rectangular base (50, fig 72 and 73),

b) two vertical parts (s1 and s2) attached on the base (50) at the top of which is attached an axle bearing two wheels (44 and 47) integral with each other,

c) two vertical parts (s3 and s4) attached to the base (50) at the top of which is attached an axle bearing two wheels (46 and 48) integral with each other,

d) two vertical parts (s5 and s6) attached to the base (50) at the top of which is attached an axle bearing three wheels, the wheels (51 and 52) being of the same dimensions, the large wheel (49) symbolizing the rear traction wheel of a bicycle, the rotation of wheels (51) and/or (52) creating the rotation of wheel (49) in the same direction,

e) a traction chain (ch 47) tying wheel (47) to the wheel (52),

f) a traction chain (ch 48) tying wheel (48) to the wheel (51),

g) four steel rods (t1, t2, t3 and t4, fig 72 and 73) attached vertically on the base (50), these 4 rods being able to slide in the cubic part (42) thanks to four holes drilled vertically at the four corners of part (42),

h) a rigid part (21, fig 74) having the shape of a platform for the foot, under which is attached an uneven Z-shaped form,

i) the uneven Z-shaped form going back and forth inside the cubic part (42) thanks to two holes drilled at the top and bottom of the cubic part (42),

j) two springs (r1 and r2) being alternatively compressed and released while the uneven Z-shaped form goes back and forth, up and down inside the cubic part (42),

k) a T-shaped part (43, fig 72) the vertical portion of which bears gear teeth which can be inserted in those of wheel (44), the horizontal portion of part (43) being able to slide back and forth on the side of the cubic part (42) and bearing a compression spring (r3) which keeps the vertical portion of part (43) against the side of cubic part (42) when this part (43) is not in contact with the uneven Z-shaped form (21) which goes back and forth vertically inside the cubic part (42),

l) a T-shaped part (45, fig 72) the vertical portion of which bears gear teeth which can be inserted in those of wheel (46), the horizontal portion of part (45) being able to slide back and forth on the side of the cubic part (42) and bearing a compression spring (r4) which keeps the vertical portion of of part (45) against the side of cubic part (42) when this part (45) is not in contact with the uneven Z-shaped form (21) which goes back and forth vertically inside the cubic part (42),

the said mechanism functionning as follows:

i- during the descending phase (fig 72), spring (r2) is compressed, the uneven Z-shaped form comes in contact with the inclined portion at the extremity of the horizontal portion of part (45), thus pushing part (45) to the right, the toothed portion of the vertical portion of part (45) engaging with the teeth of wheel (46); since part (42) slides downward along the 4 rods (t1, t2, t3 and t4), part (45)also moves downward, thus rotating wheels (46 and 48) in a counterclockwise direction, thus rotating wheels (51 and 49) in the same direction thanks to chain (ch 48),

ii- during the ascending phase (fig 75), which occurs thanks to parts 25 and/or 26 (according to the concept of fig 44), spring (r1) is compressed, the uneven Z-shaped form comes in contact with the inclined portion at the extremity of the horizontal portion of part (43), thus pushing part (43) to the left, the toothed portion of the vertical portion of part (43) engaging with the teeth of wheel (44); since part (42) slides upward along the 4 rods (t1, t2, t3 and t4), part (43)also moves upward, thus rotating wheels (44 and 47) in a counterclockwise direction, thus rotating wheels (52 and 49) in the same direction thanks to chain (ch 47),

the said mechanism, IN ADDITION to eliminating the use of the calf and of the anterior leg muscle, allows ADDITIONAL energy savings thanks to the two following facts:

1- muscles often consume energy WITHOUT producing mechanical work because of the neutral (dead) points at the top and bottom in the case of a circular crankset, the applied force cannot produce a torque on the crank (therefore no rotation of the crankset); thanks to the VERTICAL displacement of the foot and because of the fact that the applied force is ALWAYS TANGENT to the toothed wheels 44 and/or 46, the said mechanism does NOT have any neutral (or dead) points: consequently, there is no waste of this kind of energy, the muscular contraction being ALWAYS accompanied by EFFECTIVELY PRODUCED mechanical work;

2- the said mechanism MINIMIZES the use of muscles having a STRONG degree of leverage, such as the quadriceps and the bend of the knee, and MAXIMIZES the use of muscles having a WEAK degree of leverage, such as the gluteal and the iliopsoas.

7- A mechanism according to claim 1, CHARACTERISED by the following components:

a) a platform (21, Fig 79) the front end of which is secured to the rotation axis (15) at the end of the pedal crank, where was the pedal which has been removed;

b) a rotation axis (59, Fig 80) secured to the horizontal tube of the frame which supports the rear wheel;

c) a crank (53, Fig 79 and 80), of the same length as that of the pedal crank and always moving inparallel with it, this crank (53) rotating freely around the rotation axis (59);

d) an horizontal part (54) attaching the top extremities of crank (53) and the crankset's crank (15), thus always allowing the parallel movement of these two cranks (which are of the same lenght);

e) a part (55, fig 80) having a star-shaped hole inserted in the star-shaped axle (60) at the top of part (53); this part (55) is therefore integral of the crank (53) and the star-shaped hole allows to CHOOSE the angle between parts (55) and (53), this angle remaining the same during the rotation of the mechanism;

f) a part (57) adjustable to the desired position in the groove of part (55, fig 80), thus allowing to CHOOSE the length of the combined part (55 + 57);

g) an axis of rotation attached at the extremity of part (57) which is inserted in the hole of part (56, fig 80);

h) a part (58) adjustable to the desired position in the groove of part (56, fig 80), thus allowing to CHOOSE the length of the combined part (56 + 58);

i) an axis of rotation attached at the extremity of part (58) which is inserted in the rotation hole attached at the rear of the platform (21),

the said mechanism allowing the control in the increase of the angle of inclination of the foot with respect to the ground (angle , fig 76 and 77) when the foot comes up from the rear.

8- A mechanism according to claim 1, CHARACTERISED by the following components:

a) a platform (21) attached to the axis of rotation (15) at the top of the crankset's crank;

b) a toothed wheel (62) the center of which coincides with the crankser's axis of rotation, and is integral with the crankset's crank (the wheel 62 rotates WITH the crank);

c) a traction chain (63) which ties together wheel (62) and the toothed cam (67), the wheel (62) and cam (67) having the same circumference (same number of teeth);

d) an axle (65), the cam (67) being welded to one extremity of this axle, and the crank (66) being welded to the axle's (65) other extremity, in such a way that the cam (67) rotates WITH the crank (66);

e) a part (64), attached to the bike's lower frame tube, and supporting axle (65);

f) a rigid rod (68) one extremity of which bears a point of rotation (70) located at the rear of the platform (21), the other extremity bearing another point of rotation (69) located at the moving extremity of the the crank (66),

the said mechanism allowing the control in the increase of the angle of inclination of the foot with respect to the ground (angle , fig 76) when the foot comes up from the rear.

9- A mechanism according to claim 1, CHARACTERISED by the following components:

a) a platform (21, fig 82) attached from the front to the axis of rotation (15) of the crankset's crank;

b) a crank (73) attached to the axis of rotation (72) of part (71) attached to the bike's lower frame tube,

c) the crank (73) being of the same lenght and always parallel to the crankset's crank thanks to part (74) which ties the axis of rotation (15) to axis of rotation (75) located at the moving extremity of crank (73);

d) a cam (76), which is not toothed, INTEGRAL with crank (73), i.e. parts 76 and 73 form a SINGLE part (76 + 73);

e) a wheel (77) attached on the side and at the rear of platform (21), the circumference of this wheel (77) being in frictional CONTACT with the circumference of the cam (76), in such a way that, when the mechanism rotates, the wheel (77) makes a COMPLETE ROTATION of the cam (76) by rolling along the circumference of the latter,

the said mechanism allowing the control in the increase of the angle of inclination of the foot with respect to the ground (angle , fig 76) when the foot comes up from the rear.

10- A mechanism according to claim 1, CHARACTERISED by the following components:

a) a platform (21, fig 83) attached from the front to the top axis of rotation of the crankset's crank;

b) a cam (78) solidly attached (it does not rotate) to the bike's lower frame tube by a support (83), this cam having a groove along its circumference inside of which moves a wheel (82);

c) this wheel (82) rotating on the lower elbowed portion of rod (81), the top elbowed portion of the rod (81) (reversed from the lower elbowed portion) being inserted in an axis of rotation (84) located at the rear of the platform (21);

d) the part elbowed at the two extremities (81) going back and forth (during the rotation of the mechanism) inside a hole located at the top extremity of part (79);

e) this part (79) (which bears rod 81 and wheel 82) rotating around axis of rotation (80) located on cam (78),

the said mecanism allowing the control in the increase of the angle of inclination of the foot with respect to the ground (angle , fig 76) when the foot comes up from the rear.

11- A mechanism according to claim 1, CHARACTERISED by the following components:

a) a platform (21, fig 84) the front of which is attached to the top axis of rotation (15) of the crankset's crank;

b) a first rod (87) of the same length as that of the crankset's crank, an extremity of which is attached to an axis of rotation (88) located on the lower frame tube, the other extremity being attached to a point of rotation (91) located on the uneven L-shaped elbowed part (89);

c) a second rod (85) one extremity of which rotates freely on an axis of rotation (86) which coincides with the rear wheel's axis, the other extremity being attached to a point of rotation (90) located at one extremity of the uneven L-shaped elbowed part (89);

d) the other extremity of this part (89) being attached to an axis of rotation (92) located at the rear of the platform (21);

e) the distance between rotation points (90) and (91) and the length of rod (85) chosen such that, when rod (87) makes a COMPLETE ROTATION, rod (85) does NOT make a complete rotation but rather GOES BACK AND FORTH (angles 1 and 2, fig 84) with respect to the imaginary vertical (V),

the said mecanism allowing the control in the increase of the angle of inclination of the foot with respect to the ground (angle , fig 76) when the foot comes up from the rear.

12- A mechanism according to claim 1, CHARACTERISED by the following components:

a) a platform (21, fig 85) the front of which is attached to the axis of rotation (15) of the crankset's crank;

b) a rigid support (93) placed in a fixed position along the bike's lower frame tube;

c) part (93) having an encrusted groove inside of which a wheel (94) goes back and forth, this groove being in a straight line along the tube axis;

d) a rigid rod (95), an extremity of which is bearing the axis of rotation of wheel (94), the other extremity of this rod (95) being attached to an axis of rotation (99) located at the rear of the platform (21);

e) another rigid rod (96) one extremity of which is attached to an axis of rotation (97) located at the front of part (93), the other extremity of rod (96) being attached to a fixed axis of rotation (98) located near the center of rod (95),

the said mechanism allowing the control in the increase of the angle of inclination of the foot with respect to the ground (angle , fig 76) when the foot comes up from the rear.

13- A mechanism according to claim 1, CHARACTERISED by the following components:

a) a platform (21, fig 86) the front of which is attached to the extremity of the axis of rotation (15) of the crankset's crank;

b) a curved part of irregular shape (100) being integral with the platform (21), the top curved portion of this part (100) going back and forth between

c) two small wheels (102) which rest against the two borders of part (100);

d) these two small wheels (102) being tied together by two rectangular parts (101) located on each side of the two wheels (102) thanks to two axis of rotation (W);

e) the rectangular part (101), located between the bike's frame tube and the wheels (102), being attached AT ITS CENTER to the bike's frame tube thanks to an axis of rotation (Z), thus allowing the combined part (101 plus 102) TO ROTATE around the axis Z when the crankset rotates, thus keeping a TANGENT (90 degrees) contact between the two wheels (102) and the two borders of part (100) which goes back and forth between the two wheels (102),

the said mechanism allowing the control in the increase of the angle of inclination of the foot with respect to the ground (angle , fig 76) when the foot comes up from the rear.

14- A mechanism according to claim 1, CHARACTERISED by the following components:

a) a platform (21, fig 88) the front of which is attached to the extremity of the axis of rotation (15) of the crankset's crank;

b) an axle (109), which is the axis of rotation (15), and which is made as follows:

i- part (b, fig 87) of axle (109) rotates freely in part (b) at the tip of the crank which holds roller bearings;

ii- the square portion of axle (109, fig 87) is inserted in the square hole at the front of the platform (21);

iii- the grooved portion (a) of axle (109) is inserted in the grooved part (a) of cam (104), thus allowing

1- to CHOOSE the degree of inclination of the platform (21) with respect to cam (104), and

2- to make integral cam (104), axle (109) and the platform (21) as if they were a SINGLE PART;

c) a wheel (103) welded to the crankset's case, this wheel NOT BEING ABLE TO ROTATE (it is the chain 105 which goes around this wheel 103 when the crankset rotates);

d) a traction chain (105) tying the cam (104) with wheel (103), both of them having the same circumference (same number of teeth);

e) a chain tightener (106) with spring (107) which maintains a minimum tension in the top portion of chain (105), given that it is always the bottom portion of the chain which provides the propulsive tension,

the said mechanism allowing the control in the increase of the angle of inclination of the foot with respect to the ground (angle , fig 76) when the foot comes up from the rear.

15- A mechanism according to claims 6, 7, 8, 9, 10, 11, 12, 13 and 14, CHARACTERISED insofar as the platform (21, fig 44) having part (25, fig 44)

a) which is very rigid but well padded on the inside;

b) which is attached on the inside of the platform (21), thus facilitating the retrieval of the foot from the other side and/or from the rear, and the easy repositioning of the foot without having to look (with a bit of practice);

c) which covers the foot in the area near the leg, in such a way as to maintain the heel IN CONTACT with the platform when the thigh pulls upward during the ascending phase (when the foot goes up from the rear),

the said mechanism allowing to avoid the contraction of the anterior tibial muscle (23, fig 43) when the iliopsoas (22, fig 43) pulls the platform (21) upwards, thus bringing a large energy savings and provides the opportunity to utilize the iliopsoas TO ITS FULL POTENTIAL since,with a pedal and the foot attached to it, the contraction of the anterior tibial muscle LIMITS the contraction force of the iliopsoas, the anterior tibial muscle being a weak muscle (compared to the calf); in addition, the said mechanism allows the simultaneous use of both legs, resulting in a larger potential propulsive power.

16- A mechanism according to claims 5, 6, 7, 8, 9, 10, 11, 12, 13 and 14, CHARACTERISED insofar as the platform (21, fig 44 and 46) having an horizontal axle (26, fig 44 and 46)

a) which is inserted in the hole (27, fig 45) in the heel of a special shoe (28, fig 45),

b) the axis of rotation thus created (27, 26, fig 46) being located exactly under (vertically) the axis of rotation of the ankle (1, fig 46),

the said mechanism allowing to avoid the contraction of the anterior tibial muscle (23, fig 43) when the iliopsoas (22, fig 43) pulls the platform (21) upwards, thus bringing a large energy savings and provides the opportunity to utilize the iliopsoas TO ITS FULL POTENTIAL since, with a pedal and the foot attached to it, the contraction of the anterior tibial muscle LIMITS the contraction force of the iliopsoas, the anterior tibial muscle being a weak muscle (compared to the calf); in addition, the said mechanism allows the simultaneous use of both legs, resulting in a larger potential propulsive power.

END OF CLAIMS

CLAIMS

1- A **CRANKSET DEVICE** that comprises:

A) a **platform** (21, fig 44 and 46) supporting the whole of the underside of the shoe (therefore the foot), an axle (15, fig 44 and 46) mounted under the platform (21, fig 44 and 46), the extremity of this axle being inserted at the end of the crankset's crank (112, fig 44 and 46), where the pedal which has been removed was located before, the said axle (15, fig 44 and 46) being mounted under the platform (21, fig 44 and 46) in a position such that, when the shoe (therefore the foot) is placed on the platform (21, fig 46), the axis of the said axle (15, fig 46) is directly under the big toe joint (2, fig 46) as is also the case with a conventional pedal, the big toe joint (2, fig 7) being normally placed directly above the axis of rotation (the axle) of the pedal, when the foot is placed in an horizontal position with respect to the ground,

B) a **mechanism to control the angle of inclination** of the platform (21, fig 44) with respect to the ground (variable angle ,fig 76, 77 and 86), which allows the movement of the platform (therefore the foot) to be identical to the normal movement of the foot (variable angle , fig 76) when a pedal is used correctly (the big toe joint (2, fig 7) being directly above the axis of rotation (the axlė) of the pedal),

the said mechanism for the control of the angle of inclination of the platform (21, fig 44) allowing the choice of the numeric values of angle (fig 76, 77 and 86) in such a way that **the shoe heel is continuously in contact with the platform (21, fig 44 and 46) during the complete rotation of 360 degrees of the crankset**, thus implying:

a) that the platform (21, fig 44) automatically provides **support to the heel** of the shoe during the **descending** phase of the pedalling cycle, when the cyclist **pushes** on the platform (21, fig 44) when his foot goes **downwards towards the front**, starting from the top vertical position of the crank (112, fig 44 and 46) to the bottom (fig 38) vertical position of the crank (112, fig 44 and 46),

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b) that the platform automatically provides the possibility of pulling the platform upwards during the **ascending** phase of the pedalling cycle, when the crank (112, fig 44 and 46) goes from the bottom vertical position to the top vertical position when the shoe (the foot) goes upwards from the rear (fig 39), **at the condition that** the shoe is attached to the platform by appropriate technical elements, in order to make possible the upward traction on the crank (112, fig 44 and 46),

the said **CRANKSET DEVICE** being **CHARACTERIZED** as follows:

1- IT INCLUDES **a rear foot positioning guide** (111, fig 78) of 3 centimeters in height located on the inside (the side of the platform closest to the bicycle frame) of the platform (21, fig 78) a few centimeters from the rear, mounted such that the shoe heel can touch it, the foot being retrieved towards the outside of the platform (21, fig 44 and 46), as in the case of a pedal,

2- IT INCLUDES a **forward foot positioning guide** (110, fig 78) of 3 centimeters in height located on the inside of the platform (21, fig 78), having a curved shape and mounted is a manner such that the part of the shoe which holds the big toe touches this guide over a distance of a few centimeters along the forward inside part of the shoe and over a distance of a few centimeters along the front part of the shoe, just ahead of the part of the shoe holding the big toe,

3- IT INCLUDES a **rigid part** (25, fig 44 and 46), matching the shape of the shoe (fig 44 and 46), mounted in a fixed position on the inside of the platform, the curvature of this part (25, fig 44 and 46) being the same as that the shoe such that the shoe, once positioned on the platform (21, fig 44 and 46), is maintained in a fixed position (the heel touching the platform), the position of the shoe (28, fig 45) which is in contact with the part (25, fig 44 and 46) being that is near the intersection of the shoe and the leg over a distance of 5 centimeters, the part (25, fig 44 and 46) being slightly curved upwards at its top extremity to facilitate the insertion of the shoe (28), the part (25, fig 44 and 46) not covering the outside of the foot such that the retrieval of the foot can be achieved as easily as retrieving the foot towards the outside from the pedal,

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4- IT INCLUDES an **axle** (26, fig 44) AND a **shoe** (28, fig 45) **with a hole** (27, fig 45) **in the heel**, the said axle (26, fig 44) having 5 centimeters in length, being mounted in a fixed position on the rear foot positioning guide (111, fig 78) parallel parallel to the platform's surface (21, fig 44 and 46) and parallel to the axle (15, fig 44 and 46) which is mounted under the platform (21, fig 44 and 46), the said axle (26, fig 44) being mounted at a height from the surface of the platform (21, fig 44 and 46) such that, when the cyclist positions his shoe (28, fig 45) on the platform (21, fig 44 and 46), the said axle (26, fig 44 and 46) can be inserted in the hole (27, fig 45) of the shoe's heel (28, fig 45), the shoe's heel (28, fig 45) being in contact with the platform's (21, fig 44 and 46) surface when the shoe (28, fig 45) is in its final position, i.e. when the axle (26, fig 46) is fully inserted in the hole (27, fig 45) of the shoe (28, fig 45), the axis of the said axle (26, fig 46) being located exactly underneath the rotation joint of the ankle (1, fig 46) when the foot is in horizontal position (fig 46), this hole (27, fig 45) in the shoe (28, fig 45) also being parallel to the surface of the platform (21, fig 44 and 46) and parallel to the axle (15, fig 44 and 46) when the shoe (28, fig 45) is in its final position on the platform (21, fig 44 and 46) (the axle (26, fig 46) being fully inserted in the hole (27, fig 45)), the said hole (27, fig 45) having the same dimensions as the axle (26, fig 44), that is, the same length and the same diameter, except for the hole (27, fig 45) opening being enlarged in the shape of a funnel to facilitate the insertion of the axle (26, fig 44 and 46) in the hole (27, fig 45) when the cyclist places his shoe (28, fig 45) on the platform (21, fig 44 and 46),

5- the **mechanism to control the angle of inclination** of the platform (21, fig 88) INCLUDES the following technical elements:

T1- an axle (109, fig 87) constituted as follows:

a) the circular part (b, fig 87) of the axle (109, fig 87) rotates freely in part (b, fig 87) at the extremity of the crank which contains roller cylinders (108, fig 87) (usually called roller bearings)
b) the square part of the axle (109, fig 87) is inserted in the square hole at the front of the platform (21) located under the platform,

c) the grooved part (a) of the axle (109, fig 87) is inserted in the grooved part (a) of the toothed cam (104, fig 87), thus allowing:
i) to choose the angle of inclination of the platform (21, fig 87) with respect to the toothed cam (104, fig 87)
ii) to make the toothed cam (104, fig 87), the axle (109, fig 87) and the platform (21, fig 87) integral with each other as if a single rigid part,

T2- a toothed circular wheel (103, fig 87 and 88) welded to crankset casing, this wheel cannot rotate: it is the chain (105, fig 87 and 88) which goes around this wheel (103, fig 87 and 88) when the crankset rotates;

T3- a cam (104, fig 87 and 88) (evidently not circular) having the same number of teeth (therefore same circumference) as the toothed circular wheel (103, fig 87 and 88) being tied together by a traction chain (105, fig 87 and 88) equipped with spring driven chain tensor (106, 107, fig 87 and 88), the position of the cam (104, fig 87 and 88) relative to the axle (109, fig 87 and 88) is chosen to obtain the desired numerical values for the variable angle (, fig 76, 77 and 86);

2- A **CRANKSET DEVICE** that comprises:

A) a **platform** (21, fig 44 and 46) supporting the whole of the underside of the shoe (therefore of the foot), an axle (15, fig 44 and 46) mounted under the platform (21, fig 44 and 46), the extremity of this axle being inserted at the end of the crankset's crank (112, fig 44 and 46), where the pedal which has been removed was located before, the said axle (15, fig 44 and 46) being mounted under the platform (21, fig 44 and 46) in a position such that, when the shoe (therefore the foot) is placed on the platform (21, fig 46), the axis of the said axle (15, fig 46) is directly under the big toe joint (2, fig 46) as is also the case with a conventional pedal, the big toe joint (2, fig 7) being normally placed directly above the axis of rotation (the axle) of the pedal, when the foot is placed in an horizontal position with respect to the ground,

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B) a **mechanism to control the angle of inclination** of the platform (21, fig 44) with respect to the ground (variable angle ,fig 76, 77 and 86), which allows the movement of the platform (therefore the foot) to be identical to the normal movement of the foot (variable angle , fig 76) when a pedal is used correctly (the big toe joint (2, fig 7) being directly above the axis of rotation (the axle) of the pedal),

the said mechanism for the control of the angle of inclination of the platform (21, fig 44) allowing the choice of the numeric values of angle (fig 76, 77 and 86) in such a way that **the shoe heel is continuously in contact with the platform (21, fig 44 and 46) during the complete rotation of 360 degrees of the crankset**, thus implying:

a) that the platform (21, fig 44) automatically provides **support to the heel** of the shoe during the **descending** phase of the pedalling cycle, when the cyclist **pushes** on the platform (21, fig 44) when his foot goes **downwards towards the front**, starting from the top vertical position of the crank (112, fig 44 and 46) to the bottom (fig 38) vertical position of the crank (112, fig 44 and 46),

b) that the platform automatically provides the possibility of pulling the platform upwards during the **ascending** phase of the pedalling cycle, when the crank (112, fig 44 and 46) goes from the bottom vertical position to the top vertical position when the shoe (the foot) goes upwards from the rear (fig 39), **at the condition that** the shoe is attached to the platform by appropriate technical elements, in order to make possible the upward traction on the crank (112, fig 44 and 46),

the said **CRANKSET DEVICE** being **CHARACTERIZED** as follows:

1- IT INCLUDES **a rear foot positioning guide** (111, fig 78) of 3 centimeters in height located on the inside (the side of the platform closest to the bicycle frame) of the platform (21, fig 78) a few centimeters from the rear, mounted such that the shoe heel can touch it, the foot being retrieved towards the outside of the platform (21, fig 44 and 46), as in the case of a pedal,

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2- IT INCLUDES a **forward foot positioning guide** (110, fig 78) of 3 centimeters in height located on the inside of the platform (21, fig 78), having a curved shape and mounted is a manner such that the part of the shoe which holds the big toe touches this guide over a distance of a few centimeters along the forward inside part of the shoe and over a distance of a few centimeters along the front part of the shoe, just ahead of the part of the shoe holding the big toe,

3- IT INCLUDES a **rigid part** (25, fig 44 and 46), matching the shape of the shoe (fig 44 and 46), mounted in a fixed position on the inside of the platform, the curvature of this part (25, fig 44 and 46) being the same as that the shoe such that the shoe, once positioned on the platform (21, fig 44 and 46), is maintained in a fixed position (the heel touching the platform), the position of the shoe (28, fig 45) which is in contact with the part (25, fig 44 and 46) being that is near the intersection of the shoe and the leg over a distance of 5 centimeters, the part (25, fig 44 and 46) being slightly curved upwards at its top extremity to facilitate the insertion of the shoe (28), the part (25, fig 44 and 46) not covering the outside of the foot such that the retrieval of the foot can be achieved as easily as retrieving the foot towards the outside from the pedal,

4- IT INCLUDES an **axle** (26, fig 44) AND a **shoe** (28, fig 45) **with a hole** (27, fig 45) **in the heel**, the said axle (26, fig 44) having 5 centimeters in length, being mounted in a fixed position on the rear foot positioning guide (111, fig 78) parallel to the platform's surface (21, fig 44 and 46) and parallel to the axle (15, fig 44 and 46) which is mounted under the platform (21, fig 44 and 46), the said axle (26, fig 44) being mounted at a height from the surface of the platform (21, fig 44 and 46) such that, when the cyclist positions his shoe (28, fig 45) on the platform (21, fig 44 and 46), the said axle (26, fig 44 and 46) can be inserted in the hole (27, fig 45) of the shoe's heel (28, fig 45), the shoe's heel (28, fig 45) being in contact with the platform's (21, fig 44 and 46) surface when the shoe (28, fig 45) is in its final position, i.e. when the axle (26, fig 46) is fully inserted in the hole (27, fig 45) of the shoe (28, fig 45), the axis of the said axle (26, fig 46) being located exactly underneath the rotation joint of the ankle (1, fig 46) when the foot is in horizontal position (fig 46),

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this hole (27, fig 45) in the shoe (28, fig 45) also being parallel to the surface of the platform (21, fig 44 and 46) and parallel to the axle (15, fig 44 and 46) when the shoe (28, fig 45) is in its final position on the platform (21, fig 44 and 46) (the axle (26, fig 46) being fully inserted in the hole (27, fig 45)), the said hole (27, fig 45) having the same dimensions as the axle (26, fig 44), that is the same length and the same diameter, except for the hole (27, fig 45) opening being enlarged in the shape of a funnel to facilitate the insertion of the axle (26, fig 44 and 46) in the hole (27, fig 45) when the cyclist places his shoe (28, fig 45) on the platform (21, fig 44 and 46),

5- the **mechanism to control the angle of inclination** of the platform (21, fig 86) INCLUDES the following technical elements:

T1- a part of irregular shape (100, fig 86) being an integral part of the platform (21, fig 86), the lower portion of this part (100, fig 86) being mounted on the inside of the platform (21, fig 86) in a fixed position; the upper portion of the part (100, fig 86) being curved in a manner that, when the upper portion goes back and forth between wheels (102, fig 86), we obtain the desired angle of inclination (angle , fig 86 and fig 76); since the upper portion of the part (100, fig 86) ia always in contact with the two wheels at the same time, it is evident that the portion of the part (100, fig 86) which goes back and forth in between is uniform in width;

T2- two wheels 3 centimeters in radius (102, fig 86), which come to rest on the two borders of part (100, fig 86), these two small wheels (102, fig 86) being tied together by two rectangular parts (101, fig 86) located on each side of the two wheels (102, fig 86) thanks to four axis of rotation (W fig 86, two on each side), the rectangular part (101, fig 86) located between the bike's frame tube and the two wheels (102, fig 86), being mounted by its center to the bike's frame tube thanks to an axis of rotation (Z, fig 86), thus allowing the combined part (101 and 102, fig 86) to rotate around the axis (Z, fig 86) when the crankset rotates, permitting to keep in a tangent (90 degrees) between the two wheels (102, fig 86) and the two rims of part (100, fig 86) on which wheels (102, fig 86) rotate.

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3- A **CRANKSET DEVICE** that comprises:

A) a **platform** (21, fig 44 and 46) supporting the whole of the underside of the shoe (therefore of the foot), an axle (15, fig 44 and 46) mounted under the platform (21, fig 44 and 46), the extremity of this axle being inserted at the end of the crankset's crank (112, fig 44 and 46), where the pedal which has been removed was located before, the said axle (15, fig 44 and 46) being mounted under the platform (21, fig 44 and 46) in a position such that, when the shoe (therefore the foot) is placed on the platform (21, fig 46), the axis of the said axle (15, fig 46) is directly under the big toe joint (2, fig 46) as is also the case with a conventional pedal, the big toe joint (2, fig 7) being normally placed directly above the axis of rotation (the axle) of the pedal, when the foot is placed in an horizontal position with respect to the ground,

B) a **mechanism to control the angle of inclination** of the platform (21, fig 44) with respect to the ground (variable angle ,fig 76, 77 and 86), which allows the movement of the platform (therefore the foot) to be identical to the normal movement of the foot (variable angle , fig 76) when a pedal is used correctly (the big toe joint (2, fig 7) being directly above the axis of rotation (the axle) of the pedal), the said mechanism for the control of the angle of inclination of the platform (21, fig 44) allowing the choice of the numeric values of angle (fig 76, 77 and 86) in such a way that **the shoe heel is continuously in contact with the platform (21, fig 44 and 46) during the complete rotation of 360 degrees of the crankset**, thus implying:

a) that the platform (21, fig 44) automatically provides **support to the heel** of the shoe during the **descending** phase of the pedalling cycle, when the cyclist **pushes** on the platform (21, fig 44) when his foot goes **downwards towards the front**, starting from the top vertical position of the crank (112, fig 44 and 46) to the bottom (fig 38) vertical position of the crank (112, fig 44 and 46),

b) that the platform automatically provides the possibility of pulling the platform upwards during the **ascending** phase of the pedalling cycle, when the crank (112, fig 44 and 46) goes from the bottom vertical position to the top vertical position when the shoe (the foot) goes upwards from the rear (fig 39), **at the condition that** the shoe is attached to the platform by appropriate technical elements, in order to make possible the upward traction on the crank (112, fig 44 and 46),

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this **mechanism to control the angle of inclination** of the platform (21, fig 44) is comprised of:

i) an axis of rotation (59, fig 80) mounted on a collar which is installed in a fixed position around the lower horizontal frame tube supporting the rear wheel,

ii) a crank (53, fig 79 and 80), of the same length as the crankset's crank (112, fig 78) moving in parallel to the crankset's crank (112, fig 78), this crank (53, fig 79 and 80) rotating freely around the axis of rotation (59, fig 80);

the said **CRANKSET DEVICE** being **CHARACTERIZED** as follows:

1- IT INCLUDES **a rear foot positioning guide** (111, fig 78) of 3 centimeters in height located on the inside (the side of the platform closest to the bicycle frame) of the platform (21, fig 78) a few centimeters from the rear, mounted such that the shoe heel can touch it, the foot being retrieved towards the outside of the platform (21, fig 44 and 46), as in the case of a pedal,

2- IT INCLUDES a **forward foot positioning guide** (110, fig 78) of 3 centimeters in height located on the inside of the platform (21, fig 78), having a curved shape and mounted is a manner such that the part of the shoe which holds the big toe touches this guide over a distance of a few centimeters along the forward inside part of the shoe and over a distance of a few centimeters along the front part of the shoe, just ahead of the part of the shoe holding the big toe,

3- IT INCLUDES a **rigid part** (25, fig 44 and 46), matching the shape of the shoe (fig 44 and 46), mounted in a fixed position on the inside of the platform, the curvature of this part (25, fig 44 and 46) being the same as that the shoe such that the shoe, once positioned on the platform (21, fig 44 and 46), is maintained in a fixed position (the heel touching the platform), the position of the shoe (28, fig 45) which is in contact with the part (25, fig 44 and 46) being that is near the intersection of the shoe and the leg over a distance of 5 centimeters, the part (25, fig 44 and 46) being slightly curved upwards at its top extremity to facilitate the insertion of the shoe (28), the part (25, fig 44 and 46) not covering the outside of the foot such that the retrieval of the foot can be achieved as easily as retrieving the foot towards the outside from the pedal,

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4- IT INCLUDES an **axle** (26, fig 44) AND a **shoe** (28, fig 45) **with a hole** (27, fig 45) **in the heel**, the said axle (26, fig 44) having 5 centimeters in length, being mounted in a fixed position on the rear foot positioning guide (111, fig 78) parallel to the platform's surface (21, fig 44 and 46) and parallel to the axle (15, fig 44 and 46) which is mounted under the platform (21, fig 44 and 46), the said axle (26, fig 44) being mounted at a height from the surface of the platform (21, fig 44 and 46) such that, when the cyclist positions his shoe (28, fig 45) on the platform (21, fig 44 and 46), the said axle (26, fig 44 and 46) can be inserted in the hole (27, fig 45) of the shoe's heel (28, fig 45), the shoe's heel (28, fig 45) being in contact with the platform's (21, fig 44 and 46) surface when the shoe (28, fig 45) is in its final position, i.e. when the axle (26, fig 46) is fully inserted in the hole (27, fig 45) of the shoe (28, fig 45), the axis of the said axle (26, fig 46) being located exactly underneath the rotation joint of the ankle (1, fig 46) when the foot is in horizontal position (fig 46), this hole (27, fig 45) in the shoe (28, fig 45) also being parallel to the surface of the platform (21, fig 44 and 46) and parallel to the axle (15, fig 44 and 46) when the shoe (28, fig 45) is in its final position on the platform (21, fig 44 and 46) (the axle (26, fig 46) being fully inserted in the hole (27, fig 45)), the said hole (27, fig 45) having the same dimensions as the axle (26, fig 44), that is, the same length and the same diameter, except for the hole (27, fig 45) opening being enlarged in the shape of a funnel to facilitate the insertion of the axle (26, fig 44 and 46) in the hole (27, fig 45) when the cyclist places his shoe (28, fig 45) on the platform (21, fig 44 and 46),

5- the **mechanism to control the angle of inclination** of the platform (21, fig 79) INCLUDES the following technical elements:

T1- an horizontal part (54, fig 78, 79) tying together the top extremities of the crank (53, fig 79 and 80) and the crankset's crank;

T2- a part (55, fig 80) having a hole with teeth which are inserted in the axis (60, fig 80) having similar teeth at the rotating extremity of the crank (53, fig 80); this part (55, fig 80) is therefore integral with the crank (53, fig 80) and the toothed hole (55, fig 80) allows the choice of the angle between parts (55, fig 80) and (53, fig 80), this angle remaining constant during the mechanism's rotation;

T3- a straight part (57, fig 80) which can be adjusted to the desired position in the slot (or groove) of part (55, fig 80) using a small screw which traverses the sliding element (57, fig 80) and part (55, fig 80), thus allowing to choose the length of the combined part (55 plus 57, fig 80);

T4- a fixed axis of rotation at the extremity of part (57, fig 80) which is inserted in the hole of part (56, fig 80);

T5- a part (58) which can adjusted to the desired length, in a fashion similar to part (55, fig 80), in the slot (or groove) of part (56, fig 80), thus allowing to choose the length of the combined part (56 plus 58, fig 80);

T6- a fixed axis of rotation at the extremity of part (58, fig 80) which is inserted a fixed rotation hole located at the rear of the platform (21, fig 80).

4- A **CRANKSET DEVICE** that comprises:

A) a **platform** (21, fig 44 and 46) supporting the whole of the underside of the shoe (therefore of the foot), an axle (15, fig 44 and 46) mounted under the platform (21, fig 44 and 46), the extremity of this axle being inserted at the end of the crankset's crank (112, fig 44 and 46), where the pedal which has been removed was located before, the said axle (15, fig 44 and 46) being mounted under the platform (21, fig 44 and 46) in a position such that, when the shoe (therefore the foot) is placed on the platform (21, fig 46), the axis of the said axle (15, fig 46) is directly under the big toe joint (2, fig 46) as is also the case with a conventional pedal, the big toe joint (2, fig 7) being normally placed directly above the axis of rotation (the axle) of the pedal, when the foot is placed in an horizontal position with respect to the ground,

B) a **mechanism to control the angle of inclination** of the platform (21, fig 44) with respect to the ground (variable angle ,fig 76, 77 and 86), which allows the movement of the platform (therefore the foot) to be identical to the normal movement of the foot (variable angle , fig 76) when a pedal is used correctly (the big toe joint (2, fig 7) being directly above the axis of rotation (the axle) of the pedal),

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the said mechanism for the control of the angle of inclination of the platform (21, fig 44) allowing the choice of the numeric values of angle (fig 76, 77 and 86) in such a way that **the shoe heel is continuously in contact with the platform (21, fig 44 and 46) during the complete rotation of 360 degrees of the crankset**, thus implying:

a) that the platform (21, fig 44) automatically provides **support to the heel** of the shoe during the **descending** phase of the pedalling cycle, when the cyclist **pushes** on the platform (21, fig 44) when his foot goes **downwards towards the front**, starting from the top vertical position of the crank (112, fig 44 and 46) to the bottom (fig 38) vertical position of the crank (112, fig 44 and 46),

b) that the platform automatically provides the possibility of pulling the platform upwards during the **ascending** phase of the pedalling cycle, when the crank (112, fig 44 and 46) goes from the bottom vertical position to the top vertical position when the shoe (the foot) goes upwards from the rear (fig 39), **at the condition that** the shoe is attached to the platform by appropriate technical elements, in order to make possible the upward traction on the crank (112, fig 44 and 46),

this **mechanism to control the angle of inclination** of the platform (21, fig 44) is comprised of:

a) an axis of rotation (65, fig 81) mounted on a collar (64, fig 81) which is installed in a fixed position around the lower horizontal frame tube supporting the rear wheel,

b) a crank (66, fig 81), of the same length as the crankset's crank (112, fig 78) rotating freely around the axis of rotation (65, fig 81);

the said **CRANKSET DEVICE** being **CHARACTERIZED** as follows:

1- IT INCLUDES **a rear foot positioning guide** (111, fig 78) of 3 centimeters in height located on the inside (the side of the platform closest to the bicycle frame) of the platform (21, fig 78) a few centimeters from the rear, mounted such that the shoe heel can touch it, the foot being retrieved towards the outside of the platform (21, fig 44 and 46), as in the case of a pedal,

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2- IT INCLUDES a **forward foot positioning guide** (110, fig 78) of 3 centimeters in height located on the inside of the platform (21, fig 78), having a curved shape and mounted is a manner such that the part of the shoe which holds the big toe touches this guide over a distance of a few centimeters along the forward inside part of the shoe and over a distance of a few centimeters along the front part of the shoe, just ahead of the part of the shoe holding the big toe,

3- IT INCLUDES a **rigid part** (25, fig 44 and 46), matching the shape of the shoe (fig 44 and 46), mounted in a fixed position on the inside of the platform, the curvature of this part (25, fig 44 and 46) being the same as that the shoe such that the shoe, once positioned on the platform (21, fig 44 and 46), is maintained in a fixed position (the heel touching the platform), the position of the shoe (28, fig 45) which is in contact with the part (25, fig 44 and 46) being that is near the intersection of the shoe and the leg over a distance of 5 centimeters, the part (25, fig 44 and 46) being slightly curved upwards at its top extremity to facilitate the insertion of the shoe (28), the part (25, fig 44 and 46) not covering the outside of the foot such that the retrieval of the foot can be achieved as easily as retrieving the foot towards the outside from the pedal,

4- IT INCLUDES an **axle** (26, fig 44) AND a **shoe** (28, fig 45) **with a hole** (27, fig 45) **in the heel**, the said axle (26, fig 44) having 5 centimeters in length, being mounted in a fixed position on the rear foot positioning guide (111, fig 78) parallel to the platform surface (21, fig 44 and 46) and parallel to the axle (15, fig 44 and 46) which is mounted under the platform (21, fig 44 and 46), the said axle (26, fig 44) being mounted at a height from the surface of the platform (21, fig 44 and 46) such that, when the cyclist positions his shoe (28, fig 45) on the platform (21, fig 44 and 46), the said axle (26, fig 44 and 46) can be inserted in the hole (27, fig 45) of the shoe's heel (28, fig 45), the shoe's heel (28, fig 45) being in contact with the platform's (21, fig 44 and 46) surface when the shoe (28, fig 45) is in its final position, i.e. when the axle (26, fig 46) is fully inserted in the hole (27, fig 45) of the shoe (28, fig 45), the axis of the said axle (26, fig 46) being located exactly underneath the rotation joint of the ankle (1, fig 46) when the foot is in horizontal position (fig 46),

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this hole (27, fig 45) in the shoe (28, fig 45) also being parallel to the surface of the platform (21, fig 44 and 46) and parallel to the axle (15, fig 44 and 46) when the shoe (28, fig 45) is in its final position on the platform (21, fig 44 and 46) (the axle (26, fig 46) being fully inserted in the hole (27, fig 45)), the said hole (27, fig 45) having the same dimensions as the axle (26, fig 44), that is, the same length and the same diameter, except for the hole (27, fig 45) opening being enlarged in the shape of a funnel to facilitate the insertion of the axle (26, fig 44 and 46) in the hole (27, fig 45) when the cyclist places his shoe (28, fig 45) on the platform (21, fig 44 and 46),

5- the **mechanism to control the angle of inclination** of the platform (21, fig 81) INCLUDES the following technical elements:

T1- a toothed cam (67, fig 81), therefore non-circular, which is of the same circumference as that of the circular toothed wheel (62, fig 81), both having the same number of teeth, the said cam (67, fig 81) being soldered on the inside extremity of the axle (65, fig 81), the fixed extremity of the crank (66, fig 81) being soldered to the outside extremity of axle (65, fig 81) in such a way that the cam (67, fig 81), the axle (65, fig 81) and the crank (66, fig 81) are integral with each other: when the crank (66, fig 81) rotates, the cam (67, fig 81) rotates with the crank (66, fig 81), the axle (65, fig 81) which ties them rotating freely at the top of the collar (64, fig 81);

T2- a toothed wheel (62) with its center coinciding with the axis of rotation of the crankset, and which is integral (soldered to) with the crankset's crank, the wheel (62, fig 81) rotating with the crankset's crank (112, fig 78); the toothed cam (67, fig 81) and the toothed wheel (62, fig 81) are put into rotation by a traction chain (63, fig 81) which ties them together;

T3- a rigid rod (68, fig 81) one extremity of which has a rotation joint (70, fig 81) located at the rear and on the inside of the platform (21, fig 81) and the other extremity having another rotation joint (69, fig 81) located at the moving extremity of the crank (66, fig 81).

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5- A **CRANKSET DEVICE** that comprises:

A) a **platform** (21, fig 44 and 46) supporting the whole of the underside of the shoe (therefore of the foot), an axle (15, fig 44 and 46) mounted under the platform (21, fig 44 and 46), the extremity of this axle being inserted at the end of the crankset's crank (112, fig 44 and 46), where the pedal which has been removed was located before, the said axle (15, fig 44 and 46) being mounted under the platform (21, fig 44 and 46) in a position such that, when the shoe (therefore the foot) is placed on the platform (21, fig 46), the axis of the said axle (15, fig 46) is directly under the big toe joint (2, fig 46) as is also the case with a conventional pedal, the big toe joint (2, fig 7) being normally placed directly above the axis of rotation (the axle) of the pedal, when the foot is placed in an horizontal position with respect to the ground,

B) a **mechanism to control the angle of inclination** of the platform (21, fig 44) with respect to the ground (variable angle ,fig 76, 77 and 86), which allows the movement of the platform (therefore the foot) to be identical to the normal movement of the foot (variable angle , fig 76) when a pedal is used correctly (the big toe joint (2, fig 7) being directly above the axis of rotation (the axle) of the pedal), the said mechanism for the control of the angle of inclination of the platform (21, fig 44) allowing the choice of the numeric values of angle (fig 76, 77 and 86) in such a way that **the shoe heel is continuously in contact with the platform (21, fig 44 and 46) during the complete rotation of 360 degrees of the crankset**, thus implying:

a) that the platform (21, fig 44) automatically provides **support to the heel** of the shoe during the **descending** phase of the pedalling cycle, when the cyclist **pushes** on the platform (21, fig 44) when his foot goes **downwards towards the front**, starting from the top vertical position of the crank (112, fig 44 and 46) to the bottom (fig 38) vertical position of the crank (112, fig 44 and 46),

b) that the platform automatically provides the possibility of pulling the platform upwards during the **ascending** phase of the pedalling cycle, when the crank (112, fig 44 and 46) goes from the bottom vertical position to the top vertical position when the shoe (the foot) goes upwards from the rear (fig 39), **at the condition that** the shoe is attached to the platform by appropriate technical elements, in order to make possible the upward traction on the crank (112, fig 44 and 46),

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this **mechanism to control the angle of inclination** of the platform (21, fig 44) is comprised of:

a) an axis of rotation (88, fig 84) mounted on a collar which is installed in a fixed position around the lower horizontal frame tube supporting the rear wheel,

b) a crank (87, fig 84), of the same length as the crankset's crank (112, fig 78) rotating freely around the axis of rotation (88, fig 84);

the said **CRANKSET DEVICE** being **CHARACTERIZED** as follows:

1- IT INCLUDES **a rear foot positioning guide** (111, fig 78) of 3 centimeters in height located on the inside (the side of the platform closest to the bicycle frame) of the platform (21, fig 78) a few centimeters from the rear, mounted such that the shoe heel can touch it, the foot being retrieved towards the outside of the platform (21, fig 44 and 46), as in the case of a pedal,

2- IT INCLUDES a **forward foot positioning guide** (110, fig 78) of 3 centimeters in height located on the inside of the platform (21, fig 78), having a curved shape and mounted is a manner such that the part of the shoe which holds the big toe touches this guide over a distance of a few centimeters along the forward inside part of the shoe and over a distance of a few centimeters along the front part of the shoe, just ahead of the part of the shoe holding the big toe,

3- IT INCLUDES a **rigid part** (25, fig 44 and 46), matching the shape of the shoe (fig 44 and 46), mounted in a fixed position on the inside of the platform, the curvature of this part (25, fig 44 and 46) being the same as that the shoe such that the shoe, once positioned on the platform (21, fig 44 and 46), is maintained in a fixed position (the heel touching the platform), the position of the shoe (28, fig 45) which is in contact with the part (25, fig 44 and 46) being that is near the intersection of the shoe and the leg over a distance of 5 centimeters, the part (25, fig 44 and 46) being slightly curved upwards at its top extremity to facilitate the insertion of the shoe (28), the part (25, fig 44 and 45) not covering the outside of the foot such that the retrieval of the foot can be achieved as easily as retrieving the foot towards the outside from the pedal,

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4- IT INCLUDES an **axle** (26, fig 44) AND a **shoe** (28, fig 45) **with a hole** (27, fig 45) **in the heel**, the said axle (26, fig 44) having 5 centimeters in length, being mounted in a fixed position on the rear foot positioning guide (111, fig 78) parallel to the platform surface (21, fig 44 and 46) and parallel to the axle (15, fig 44 and 46) which is mounted under the platform (21, fig 44 and 46), the said axle (26, fig 44) being mounted at a height from the surface of the platform (21, fig 44 and 46) such that, when the cyclist positions his shoe (28, fig 45) on the platform (21, fig 44 and 46), the said axle (26, fig 44 and 46) can be inserted in the hole (27, fig 45) of the shoe's heel (28, fig 45), the shoe's heel being in contact with the platform's (21, fig 44 and 46) surface when the shoe is in its final position, i.e. when the axle (26, fig 46) is fully inserted in the hole (27, fig 45) of the shoe (28, fig 45), the axis of the said axle (26, fig 46) being located exactly underneath the rotation joint of the ankle (1, fig 46) when the foot is in horizontal position (fig 46), this hole (27, fig 45) in the shoe (28, fig 45) also being parallel to the surface of the platform (21, fig 44 and 46) and parallel to the axle (15, fig 44 and 46) when the shoe (28, fig 45) is in its final position on the platform (21, fig 44 and 46) (the axle (26, fig 46) being fully inserted in the hole (27, fig 45)), the said hole (27, fig 45) having the same dimensions as the axle (26, fig 44), that is, the same length and the same diameter, except for the hole (27, fig 45) opening being enlarged in the shape of a funnel to facilitate the insertion of the axle (26, fig 44 and 46) in the hole (27, fig 45) when the cyclist places his shoe (28, fig 45) on the platform (21, fig 44 and 46),

5- the **mechanism to control the angle of inclination** of the platform (21, fig 84) INCLUDES the following technical elements:

T1- a rigid part (89, fig 84) having an elbow (in the shape of an inverted **L**), the said part (89, fig 84) comprised of 3 rotation joints (90, 91 and 92, fig 84),

T2- a crank (85, fig 84) one extremity of which rotates freely around one rotation joint (86, fig 84) coinciding with the axis of the bike's rear wheel, but independently of this axis of rotation of the bike's rear wheel (the rotation of the bike's rear wheel having no influence on the crank's (85, fig 84) free movement,

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T3- the rotation joint (90, fig 84) located at the extremity of part (89, fig 84) is mounted on an axis of rotation located at the moving extremity of the crank (85, fig 84),

T4- the rotation joint (92, fig 84) located at the other extremity of part (89, fig 84) is mounted on an axis of rotation located at the platform (21, fig 84) on the inside of the platform (21, fig 84),

T5- the rotation joint (91, fig 84) located on the elbow of part (89, fig 84) is mounted on an axis of rotation located on the moving extremity of the crank (87, fig 84),

T6- the exact triangular position of these 3 rotation joints (90, 91 and 92, fig 84) on part (89, fig 84) are chosen in a manner that, when the crank (87, fig 84) does not make a complete rotation, but rather goes back and forth (angles 1 and 2, fig 84) with respect to the imaginary vertical (V, fig 84).

6- A **CRANKSET DEVICE** that comprises:

A) a **platform** (21, fig 44 and 46) supporting the whole of the underside of the shoe (therefore of the foot), an axle (15, fig 44 and 46) mounted under the platform (21, fig 44 and 46), the extremity of this axle being inserted at the end of the crankset's crank (112, fig 44 and 46), where the pedal which has been removed was located before, the said axle (15, fig 44 and 46) being mounted under the platform (21, fig 44 and 46) in a position such that, when the shoe (therefore the foot) is placed on the platform (21, fig 46), the axis of the said axle (15, fig 46) is directly under the big toe joint (2, fig 46) as is also the case with a conventional pedal, the big toe joint (2, fig 7) being normally placed directly above the axis of rotation (the axle) of the pedal, when the foot is placed in an horizontal position with respect to the ground,

B) a **mechanism to control the angle of inclination** of the platform (21, fig 44) with respect to the ground (variable angle ,fig 76, 77 and 86), which allows the movement of the platform (therefore the foot) to be identical to the normal movement of the foot (variable angle , fig 76) when a pedal is used correctly (the big toe joint (2, fig 7) being directly above the axis of rotation (the axle) of the pedal), the said mechanism for the control of the angle of inclination of the platform (21, fig 44) allowing the choice of the numeric values of angle (fig 76, 77 and 86) in such a way that **the shoe heel is continuously in contact with the platform (21, fig 44 and 46) during the complete rotation of 360 degrees of the crankset**, thus implying:

a) that the platform (21, fig 44) automatically provides **support to the heel** of the shoe during the **descending** phase of the pedalling cycle, when the cyclist **pushes** on the platform (21, fig 44) when his foot goes **downwards towards the front**, starting from the top vertical position of the crank (112, fig 44 and 46) to the bottom (fig 38) vertical position of the crank (112, fig 44 and 46),

b) that the platform automatically provides the possibility of pulling the platform upwards during the **ascending** phase of the pedalling cycle, when the crank (112, fig 44 and 46) goes from the bottom vertical position to the top vertical position when the shoe (the foot) goes upwards from the rear (fig 39), **at the condition that** the shoe is attached to the platform by appropriate technical elements, in order to make possible the upward traction on the crank (112, fig 44 and 46),

the said **CRANKSET DEVICE** being **CHARACTERIZED** as follows:

1- IT INCLUDES **a rear foot positioning guide** (111, fig 78) of 3 centimeters in height located on the inside (the side of the platform closest to the bicycle frame) of the platform (21, fig 78) a few centimeters from the rear, mounted such that the shoe heel can touch it, the foot being retrieved towards the outside of the platform (21, fig 44 and 46), as in the case of a pedal,

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2- IT INCLUDES a **forward foot positioning guide** (110, fig 78) of 3 centimeters in height located on the inside of the platform (21, fig 78), having a curved shape and mounted is a manner such that the part of the shoe which holds the big toe touches this guide over a distance of a few centimeters along the forward inside part of the shoe and over a distance of a few centimeters along the front part of the shoe, just ahead of the part of the shoe holding the big toe,

3- IT INCLUDES a **rigid part** (25, fig 44 and 46), matching the shape of the shoe (fig 44 and 46), mounted in a fixed position on the inside of the platform, the curvature of this part (25, fig 44 and 46) being the same as that the shoe such that the shoe, once positioned on the platform (21, fig 44 and 46), is maintained in a fixed position (the heel touching the platform), the position of the shoe (28, fig 45) which is in contact with the part (25, fig 44 and 46) being that is near the intersection of the shoe and the leg over a distance of 5 centimeters, the part (25, fig 44 and 46) being slightly curved upwards at its top extremity to facilitate the insertion of the shoe (28), the part (25, fig 44 and 46) not covering the outside of the foot such that the retrieval of the foot can be achieved as easily as retrieving the foot towards the outside from the pedal,

4- IT INCLUDES an **axle** (26, fig 44) AND a **shoe** (28, fig 45) **with a hole** (27, fig 45) **in the heel**, the said axle (26, fig 44) having 5 centimeters in length, being mounted in a fixed position on the rear foot positioning guide (111, fig 78) parallel to the platform surface (21, fig 44 and 46) and parallel to the axle (15, fig 44 and 46) which is mounted under the platform (21, fig 44 and 46), the said axle (26, fig 44) being mounted at a height from the surface of the platform (21, fig 44 and 46) such that, when the cyclist positions his shoe (28, fig 45) on the platform (21, fig 44 and 46), the said axle (26, fig 44 and 46) can be inserted in the hole (27, fig 45) of the shoe's heel (28, fig 45), the shoe's heel being in contact with the platform's (21, fig 44 and 46) surface when the shoe (28, fig 45) is in its final position, i.e. when the axle (26, fig 46) is fully inserted in the hole (27, fig 45) of the shoe (28, fig 45), the axis of the said axle (26, fig 46) being located exactly underneath the rotation joint of the ankle (1, fig 46) when the foot is in horizontal position (fig 46), this hole (27, fig 45) in the shoe (28, fig 45) also being parallel to the surface of the platform (21, fig 44 and 46) and parallel to the axle (15, fig 44 and 46) when the shoe (28, fig 45) is in its final position on the platform (21, fig 44 and 46) (the axle (26, fig 46) being fully inserted in the hole (27, fig 45)),

the said hole (27, fig 45) having the same dimensions as the axle (26, fig 44), that is the same length and the same diameter, except for the hole (27, fig 45) opening being enlarged in the shape of a funnel to facilitate the insertion of the axle (26, fig 44 and 46) in the hole (27, fig 45) when the cyclist places his shoe (28, fig 45) on the platform (21, fig 44 and 46),

5- the **mechanism to control the angle of inclination** of the platform (21, fig 85) INCLUDES the following technical elements:

T1-a part (93, fig 85) mounted in a fixed position along the lower frame tube supporting the rear wheel, this part (93, fig 85) having a groove inside which a wheel (94, fig 85) can rotate while going back and forth along the groove, the said groove being straight,

T2- a rigid rod (95, fig 85), one extremity of this rigid rod (95, fig 85) bearing a rotation joint mounted on the axis of rotation of the wheel (94, fig 85), the other extremity of the rigid rod (95, fig 85) bearing a rotation joint mounted on an axis of rotation (99, fig 85) located at the rear of the platform (21, fig 85) on the inside,

T3- another rigid rod (96, fig 85) one extremity of which bears a rotation joint (97, fig 85) mounted on an axis of rotation located at the front of part (93, fig 85) just before the beginning of the groove, the other extremity (mobile) of the rigid rod (96, fig 85) also bearing a rotation joint (98, fig 85) mounted on an axis of rotation located in a fixed position on the rigid rod (95, fig 85) at the center of the rigid rod (95, fig 85).

7- A **CRANKSET DEVICE** that comprises:

A) a **platform** (21, fig 44 and 46) supporting the whole of the underside of the shoe (therefore of the foot), an axle (15, fig 44 and 46) mounted under the platform (21, fig 44 and 46), the extremity of this axle being inserted at the end of the crankset's crank (112, fig 44 and 46), where the pedal which has been removed was located before, the said axle (15, fig 44 and 46) being mounted under the platform (21, fig 44 and 46) in a position such that, when the shoe (therefore the foot) is placed on the platform (21, fig 46),

the axis of the said axle (15, fig 46) is directly under the big toe joint (2, fig 46) as is also the case with a conventional pedal, the big toe joint (2, fig 7) being normally placed directly above the axis of rotation (the axle) of the pedal, when the foot is placed in an horizontal position with respect to the ground,

B) a **mechanism to control the angle of inclination** of the platform (21, fig 44) with respect to the ground (variable angle ,fig 76, 77 and 86), which allows the movement of the platform (therefore the foot) to be identical to the normal movement of the foot (variable angle , fig 76) when a pedal is used correctly (the big toe joint (2, fig 7) being directly above the axis of rotation (the axle) of the pedal), the said mechanism for the control of the angle of inclination of the platform (21, fig 44) allowing the choice of the numeric values of angle (fig 76, 77 and 86) in such a way that **the shoe heel is continuously in contact with the platform (21, fig 44 and 46) during the complete rotation of 360 degrees of the crankset**, thus implying:

a) that the platform (21, fig 44) automatically provides **support to the heel** of the shoe during the **descending** phase of the pedalling cycle, when the cyclist **pushes** on the platform (21, fig 44) when his foot goes **downwards towards the front**, starting from the top vertical position of the crank (112, fig 44 and 46) to the bottom (fig 38) vertical position of the crank (112, fig 44 and 46),

b) that the platform automatically provides the possibility of pulling the platform upwards during the **ascending** phase of the pedalling cycle, when the crank (112, fig 44 and 46) goes from the bottom vertical position to the top vertical position when the shoe (the foot) goes upwards from the rear (fig 39), **at the condition that** the shoe is attached to the platform by appropriate technical elements, in order to make possible the upward traction on the crank (112, fig 44 and 46),

the said **CRANKSET DEVICE** being **CHARACTERIZED** as follows:

1- IT INCLUDES **a rear foot positioning guide** (111, fig 78) of 3 centimeters in height located on the inside (the side of the platform closest to the bicycle frame) of the platform (21, fig 78) a few centimeters from the rear, mounted such that the shoe heel can touch it, the foot being retrieved towards the outside of the platform (21, fig 44 and 46), as in the case of a pedal,

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2- IT INCLUDES a **forward foot positioning guide** (110, fig 78) of 3 centimeters in height located on the inside of the platform (21, fig 78), having a curved shape and mounted is a manner such that the part of the shoe which holds the big toe touches this guide over a distance of a few centimeters along the forward inside part of the shoe and over a distance of a few centimeters along the front part of the shoe, just ahead of the part of the shoe holding the big toe,

3- IT INCLUDES a **rigid part** (25, fig 44 and 46), matching the shape of the shoe (fig 44 and 46), mounted in a fixed position on the inside of the platform, the curvature of this part (25, fig 44 and 46) being the same as that the shoe such that the shoe, once positioned on the platform (21, fig 44 and 46), is maintained in a fixed position (the heel touching the platform), the position of the shoe (28, fig 45) which is in contact with the part (25, fig 44 and 46) being that is near the intersection of the shoe and the leg over a distance of 5 centimeters, the part (25, fig 44 and 46) being slightly curved upwards at its top extremity to facilitate the insertion of the shoe (28), the part (25, fig 44 and 46) not covering the outside of the foot such that the retrieval of the foot can be achieved as easily as retrieving the foot towards the outside from the pedal,

4- IT INCLUDES an **axle** (26, fig 44) AND a **shoe** (28, fig 45) **with a hole** (27, fig 45) **in the heel**, the said axle (26, fig 44) having 5 centimeters in length, being mounted in a fixed position on the rear foot positioning guide (111, fig 78) parallel to the platform surface (21, fig 44 and 46) and parallel to the axle (15, fig 44 and 46) which is mounted under the platform (21, fig 44 and 46), the said axle (26, fig 44) being mounted at a height from the surface of the platform (21, fig 44 and 46) such that, when the cyclist positions his shoe (28, fig 45) on the platform (21, fig 44 and 46), the said axle (26, fig 44 and 46) can be inserted in the hole (27, fig 45) of the shoe's heel (28, fig 45), the shoe's heel (28, fig 45) being in contact with the platform's (21, fig 44 and 46) surface when the shoe (28, fig 45) is in its final position, i.e. when the axle (26, fig 46) is fully inserted in the hole (27, fig 45) of the shoe (28, fig 45), the axis of the said axle (26, fig 46) being located exactly underneath the rotation joint of the ankle (1, fig 46) when the foot is in horizontal position (fig 46), this hole (27, fig 45) in the shoe (28, fig 45) also being parallel to the surface of the platform (21, fig 44 and 46) and parallel to the axle (15, fig 44 and 46) when the shoe (28, fig 45) is in its final position on the platform (21, fig 44 and 46) (the axle (26, fig 46) being fully inserted in the hole (27, fig 45)),

the said hole (27, fig 45) having the same dimensions as the axle (26, fig 44), that is, the same length and the same diameter, except for the hole (27, fig 45) opening being enlarged in the shape of a funnel to facilitate the insertion of the axle (26, fig 44 and 46) in the hole (27, fig 45) when the cyclist places his shoe (28, fig 45) on the platform (21, fig 44 and 46),

5- the **mechanism to control the angle of inclination** of the platform (21, fig 83) INCLUDES the following technical elements:

T1-a collar (83, fig 83) wrapped around the lower frame tube in a fixed position, this collar (83, fig 83) having a length equal to the cam's width (78, fig 83) as measured along the lower frame tube,

T2- a cam (non-circular) (78, fig 83) bearing a groove along its circumference inside which rotates a wheel (82, fig 83); this cam (78, fig 83) being mounted in a fixed position on the collar (83, fig 83),

T3- the wheel (82, fig 83) rotates on an axis made up of the lower elbowed part of the rod (81, fig 83), the upper elbowed part (81, fig 83) being in the reverse direction from that of the lower elbowed part (which bears the wheel (82, fig 83)), the upper elbowed part of the rod (81, fig 83) being inserted in an axis of rotation (84, fig 83) located at the rear of the platform (21, fig 83), the part elbowed at both ends (81, fig 83) going back and forth inside the cylindrical hole located at the top of part (79, fig 83), this cylindrical hole being integral with part (79, fig 83), this part (79, fig 83) rotating around the fixed axis of rotation (80, fig 83) placed at an appropriate location on the cam (78, fig 83), in a way to obtain the desired numerical values for the variable angle (fig 76, 77 and 86).

8- A **CRANKSET DEVICE** that comprises a **platform** (21, fig 56) supporting the whole of the underside of the shoe,

the said **CRANKSET DEVICE** being **CHARACTERIZED** as follows:

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1- IT INCLUDES **a rear foot positioning guide** (111, fig 78) of 3 centimeters in height located on the inside (the side of the platform closest to the bicycle frame) of the platform (21, fig 78) a few centimeters from the rear, mounted such that the shoe heel can touch it, the foot being retrieved towards the outside of the platform (21, fig 44 and 46), as in the case of a pedal,

2- IT INCLUDES a **forward foot positioning guide** (110, fig 78) of 3 centimeters in height located on the inside of the platform (21, fig 78), having a curved shape and mounted is a manner such that the part of the shoe which holds the big toe touches this guide over a distance of a few centimeters along the forward inside part of the shoe and over a distance of a few centimeters along the front part of the shoe, just ahead of the part of the shoe holding the big toe,

3- IT INCLUDES a **rigid part** (25, fig 44 and 46), matching the shape of the shoe (fig 44 and 46), mounted in a fixed position on the inside of the platform, the curvature of this part (25, fig 44 and 46) being the same as that the shoe such that the shoe, once positioned on the platform (21, fig 44 and 46), is maintained in a fixed position (the heel touching the platform), the position of the shoe (28, fig 45) which is in contact with the part (25, fig 44 and 46) being that is near the intersection of the shoe and the leg over a distance of 5 centimeters, the part (25, fig 44 and 46) being slightly curved upwards at its top extremity to facilitate the insertion of the shoe (28), the part (25, fig 44 and 45) not covering the outside of the foot such that the retrieval of the foot can be achieved as easily as retrieving the foot towards the outside from the pedal,

4- IT INCLUDES **a rigid triangle** one side of which (37, fig 56) is mounted in a fixed position at the rear of the platform (21, fig 56) on the inside, the other side of the rigid triangle (38, fig 56) being mounted in a fixed position at the center of the inside of the platform,

5- IT INCLUDES **an L-shaped rigid part** (40, fig 56) with its vertical portion mounted in a fixed position at the intersection of the sides of the rigid triangle (37, 38, fig 56),

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6- IT INCLUDES **a part** (39, fig 58)**with a hole**, the said part (39) rotating freely in the axis (15, fig 59) of the extremity of the crankset's crank, where the pedal used to be prior to being removed, the vertical portion of the L-shaped rigid part (40, fig 56) being inserted in the hole of the said part (39, fig 58),

7- IT INCLUDES **a weak compression spring** (41, fig 56) inserted along the vertical portion of the L-shaped rigid part (40, fig 56), between the intersection of the sides (37, 38, fig 59) and the top of the hole in the part (39, fig 59), part (39, fig 58) going back and forth by sliding along the vertical portion of the L-shaped rigid part (40, fig 59), as the spring is compressed (41, fig 59) during the descending phase (fig 38) or is released (41, fig 56) during the ascending phase (fig 39),

8- IT INCLUDES **a shoe** (28, fig 45) **with a hole** (27, fig 45) **in the heel**, the horizontal portion of the rigid part (40, fig 56) being inserted in the hole (27, fig 45) of the said shoe (28, fig 45), such that the heel of the shoe (28, fig 45) is continuously in contact with the platform (21, fig 56) during the descending (fig 38, 59 and 60) AND ascending (fig 39, 56 and 57) phases, the said hole (27, fig 45) having the same dimensions than horizontal portion of the L-shaped rigid part (40, fig 56), that is the same length and diameter (except for the hole opening), the said hole opening (27, fig 45) being enlarged in the shape of a funnel to facilitate the insertion of the horizontal portion of the rigid part (40 fig 56) in the hole (27, fig 45) when the cyclist places his shoe (28, fig 45) on the platform (21, fig 56).

9- A **CRANKSET DEVICE** that comprises a **platform** (21, fig 72, 73, 74 and 75) supporting the whole of the underside of the shoe (therefore the foot),

the said **CRANKSET DEVICE** being **CHARACTERIZED** as follows:

1- IT INCLUDES **a rear foot positioning guide** (111, fig 78) of 3 centimeters in height located on the inside (the side of the platform closest to the bicycle frame) of the platform (21, fig 78) a few centimeters from the rear, mounted such that the shoe heel can touch it, the foot being retrieved towards the outside of the platform (21, fig 44 and 46), as in the case of a pedal,

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2- IT INCLUDES a **forward foot positioning guide** (110, fig 78) of 3 centimeters in height located on the inside of the platform (21, fig 78), having a curved shape and mounted is a manner such that the part of the shoe which holds the big toe touches this guide over a distance of a few centimeters along the forward inside part of the shoe and over a distance of a few centimeters along the front part of the shoe, just ahead of the part of the shoe holding the big toe,

3- IT INCLUDES a **rigid part** (25, fig 44 and 46, and 25, fig 75), matching the shape of the shoe (fig 44 and 46), mounted in a fixed position on the inside of the platform, the curvature of this part (25, fig 44 and 46) being the same as that the shoe such that the shoe, once positioned on the platform (21, fig 44 and 46), is maintained in a fixed position (the heel touching the platform), the position of the shoe (28, fig 45) which is in contact with the part (25, fig 44 and 46) being that is near the intersection of the shoe and the leg over a distance of 5 centimeters, the part (25, fig 44 and 46) being slightly curved upwards at its top extremity to facilitate the insertion of the shoe (28), the part (25, fig 44 and 46) not covering the outside of the foot such that the retrieval of the foot can be achieved as easily as retrieving the foot towards the outside from the pedal,

4- IT INCLUDES an **axle** (26, fig 44) AND a **shoe** (28, fig 45) **with a hole** (27, fig 45) **in the heel**, the said axle (26, fig 44) having 5 centimeters in length, being mounted in a fixed position on the rear foot positioning guide (111, fig 78) parallel to the platform surface (21, fig 44 and 46) and parallel to the axle (15, fig 44 and 46) which is mounted under the platform (21, fig 44 and 46), the said axle (26, fig 44) being mounted at a height from the surface of the platform (21, fig 44 and 46) such that, when the cyclist positions his shoe (28, fig 45) on the platform (21, fig 44 and 46), the said axle (26, fig 44 and 46) can be inserted in the hole (27, fig 45) of the shoe's heel (28, fig 45), the shoe's heel being in contact with the platform's (21, fig 44 and 46) surface when the shoe is in its final position, i.e. when the axle (26, fig 46) is fully inserted in the hole (27, fig 45) of the shoe (28, fig 45), the axis of the said axle (26, fig 46) being located exactly underneath the rotation joint of the ankle (1, fig 46) when the foot is in horizontal position (fig 46),

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this hole (27, fig 45) in the shoe (28, fig 45) also being parallel to the surface of the platform (21, fig 44 and 46) and parallel to the axle (15, fig 44 and 46) when the shoe (28, fig 45) is in its final position on the platform (21, fig 44 and 46) (the axle (26, fig 46) being fully inserted in the hole (27, fig 45)), the said hole (27, fig 45) having the same dimensions as the axle (26, fig 44), that is, the same length and the same diameter, except for the hole (27, fig 45) opening being enlarged in the shape of a funnel to facilitate the insertion of the axle (26, fig 44 and 46) in the hole (27, fig 45) when the cyclist places his shoe (28, fig 45) on the platform (21, fig 44 and 46),

5- IT INCLUDES **an uneven Z-shaped rigid part** (fig 74) mounted in a fixed position under the platform (21, fig 74) and is integral with the platform,

6- IT INCLUDES **a rectangular base** (50, fig 72 and 73), the said rectangular base having 2 vertical rigid rods (s1 and s2, fig 72 and 73) mounted in a fixed position at the front of the rectangular base (50, fig 72 and 73), two other rigid vertical rods (s3 and s4, fig 72 and 73) being mounted in a similar fashion immediately at the rear of the platform, and also two more (s5 and s6, fig 72 and 73) again being mounted in a similar fashion at the rear of the rectangular base (50, fig 72 and 73), each of these pairs of rods (s1 + s2, s3 + s4, s5 + s6) bearing at their top extremity a horizontal axis of rotation on which are mounted 2 gear wheels in fixed positions (44 and 47 for s1 + s2, 46 and 48 for s3 + s4, 51 and 52 for s5 + s6, fig 73), each of these pairs of gear wheels being integral with each other (they rotate together), a traction chain (ch47, fig 73) tying the gear wheels (47 and 52, fig 73) together, another traction chain (ch48, fig 73) tying together the gear wheels (48 and 51, fig 73), the rear wheel of the bike (symbolized by wheel 49) rotating (always in the same direction) when one or the other of the two gear wheels (51 or 52. fig 72 and 73) rotates, the gear wheels (51 and 52, fig 72 and 73) always rotating in the same direction,

7- IT INCLUDES **four steel rods** (t1, t2, t3 and t4, fig 72 and 73) mounted vertically on the base (50, fig 72 and 73) in a fixed position (in a rectangular position as seen from the top, a rod at each corner of a rectangle),

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8- IT INCLUDES **a steel cubic form** (hollow) (42, fig 72 and 73), the said cubic form having 4 rectangular holes (one at the top, one at the bottom, another at the front and the last one at the rear) together with 4 vertical holes on the 4 corners from top to bottom vertically, in these 4 holes are inserted the 4 steel rods (t1, t2, t3 and t4, fig 72 and 73), the steel cubic form (42, fig 72 and 73) being able to slide freely (up and down) along the four steel rods (t1, t2, t3 and t4, fig 72 and 73), the uneven Z-shaped rigid part (21, fig 74) going back and forth (up and down) inside the steel cubic form (42, fig 72 and 73) thanks to the 2 rectangular holes drilled at the top and bottom of the steel cubic form (42, fig 73), two springs (r1 and r2, fig 72) being inserted in the two vertical portions of the uneven Z-shaped part attached under the platform (fig 74), these two springs (r1 and r2) being alternatively compressed and released as the uneven Z-shaped part fixed under the platform goes back and forth up and down inside the steel cubic form (42, fig 72 and 73),

9- IT INCLUDES **a T-shaped part** (43, fig 72) with its vertical portion bearing gear teeth which can be inserted in those of the wheel (44, fig 73), the horizontal portion of the part (43, fig 72) being able to slide back and forth in the hole on the front side of the cubic form (42, fig 72) and bears a compression spring (r3, fig 72) which maintains the vertical portion of part (43, fig 72) pressing against the side of thé cubic form (42, fig 72) when the inclined portion of this part (43, fig 72) is not in contact with the inclined portion of the uneven Z-shaped part attached under the platform (fig 74),

10- IT INCLUDES **a T-shaped part** (45, fig 72) with its vertical portion bearing gear teeth which can be inserted in those of the wheel (46, fig 73), the horizontal portion of the part (45, fig 72) being able to slide back and forth in the hole on the front side of the cubic form (42, fig 72) and bears a compression spring (r4, fig 72) which maintains the vertical portion of part (45, fig 72) pressing against the side of the cubic form (42, fig 72) when the inclined portion of this part (45, fig 72) is not in contact with the inclined portion of the uneven Z-shaped part attached under the platform (fig 74).

END OF CLAIMS

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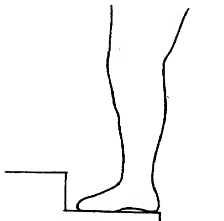

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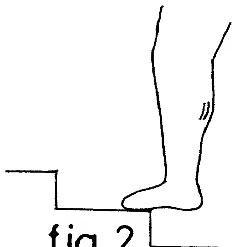

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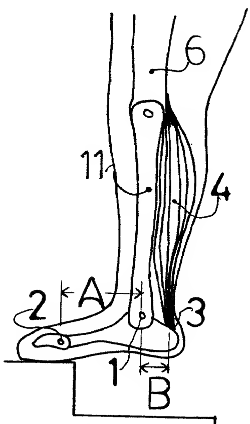

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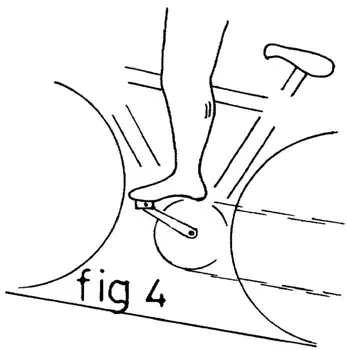

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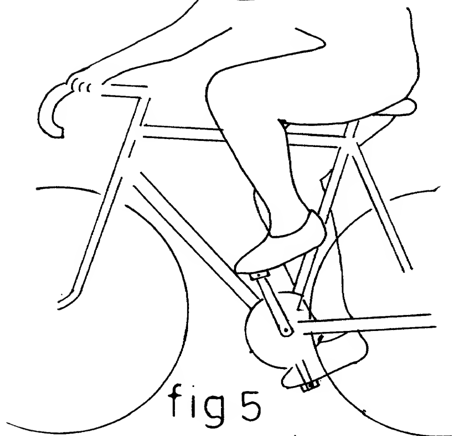

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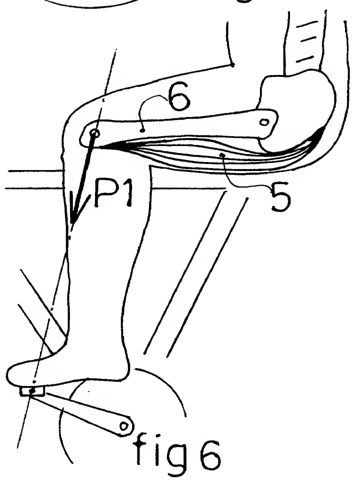

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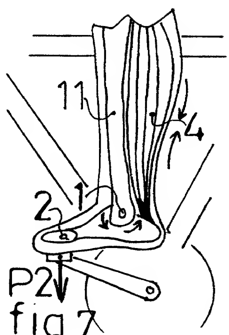

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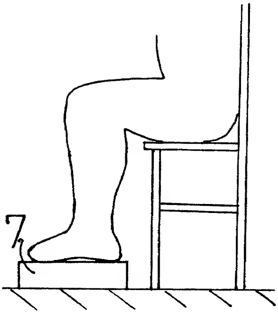

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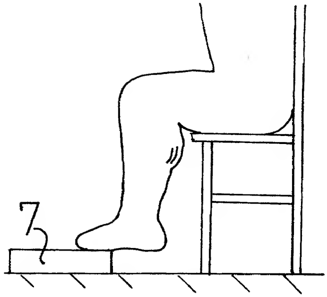

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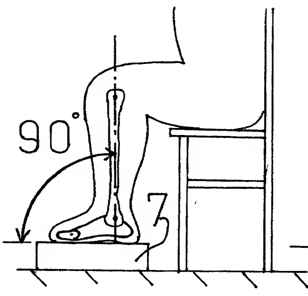

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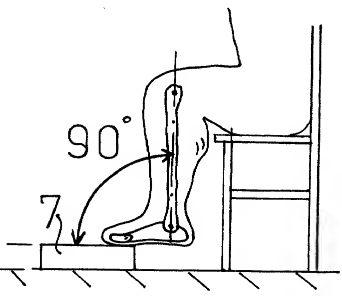

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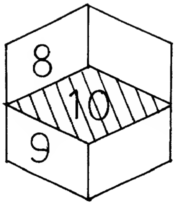

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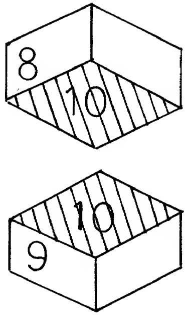

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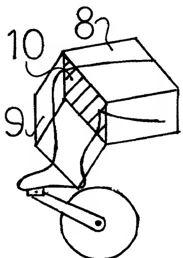

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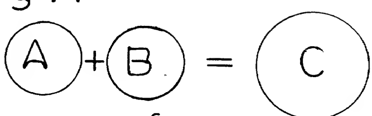

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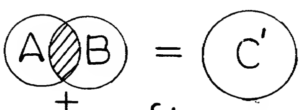

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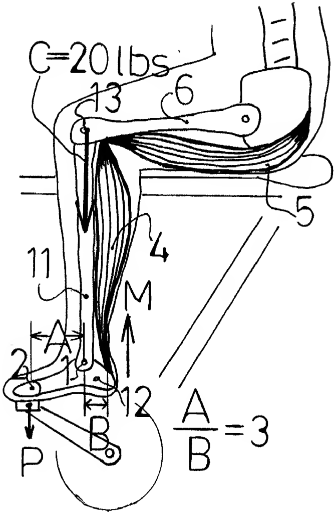

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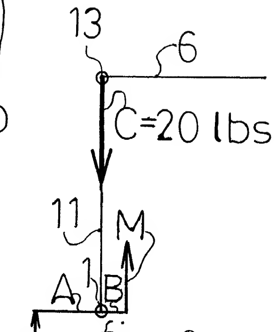

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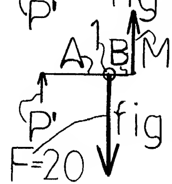

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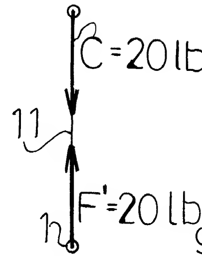

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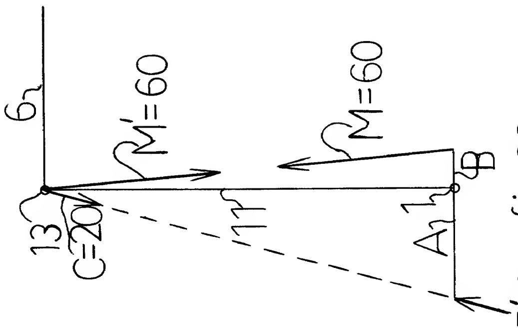

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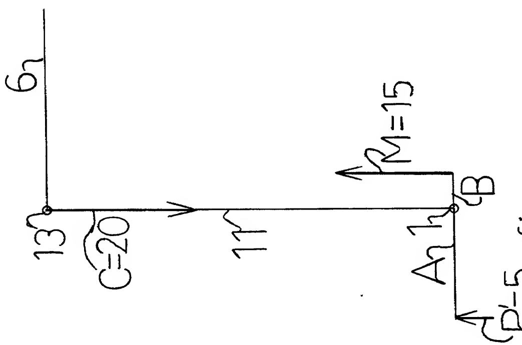

fig 21

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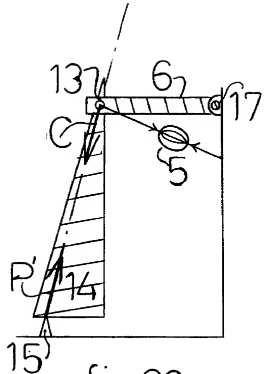

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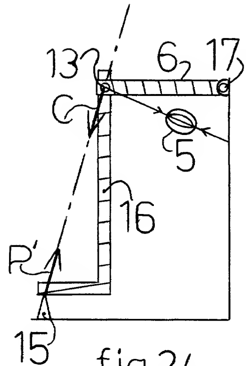

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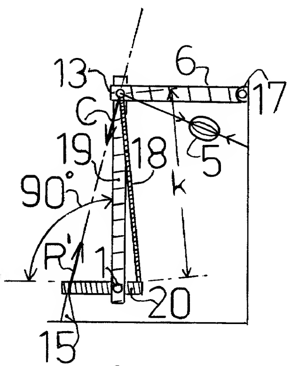

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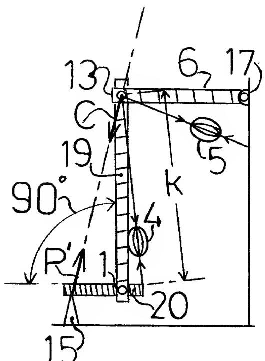

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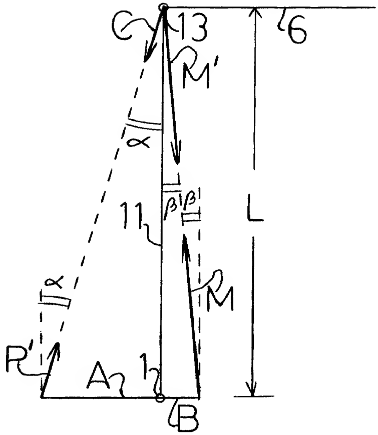

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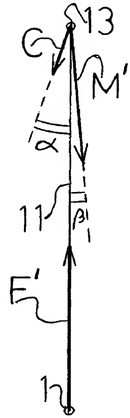

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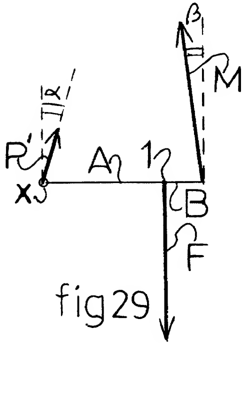

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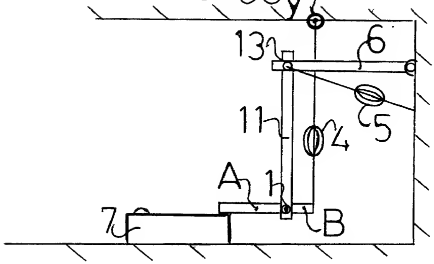

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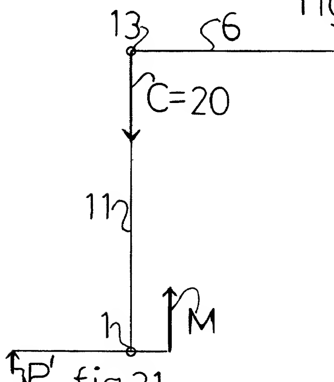

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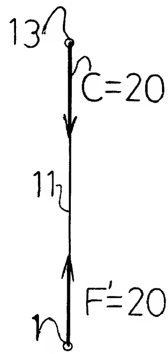

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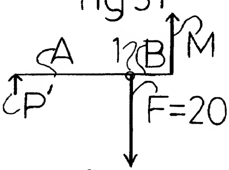

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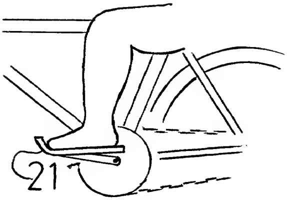

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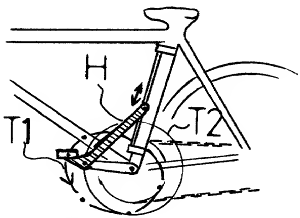

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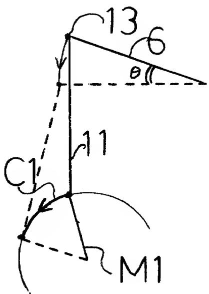

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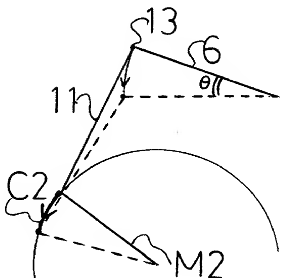

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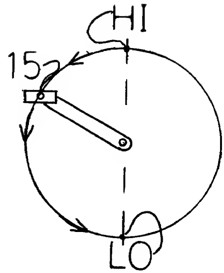

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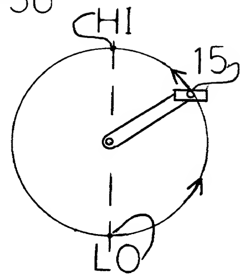

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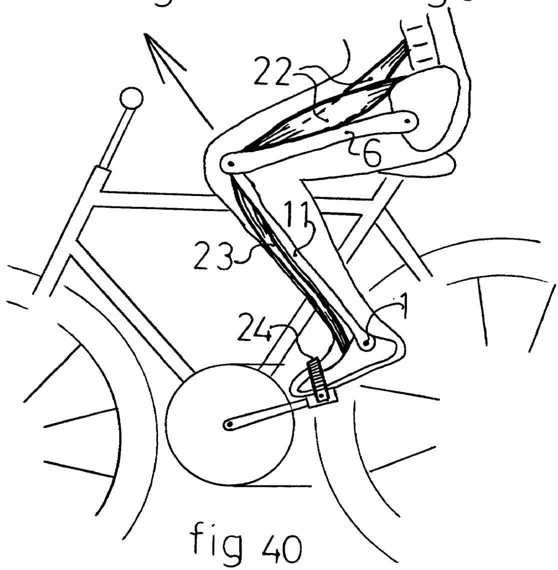

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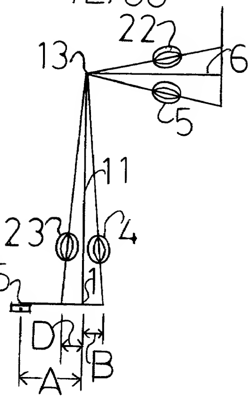

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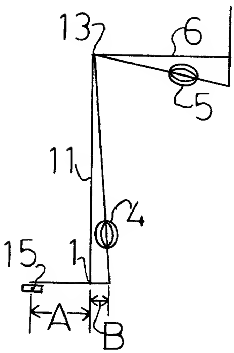

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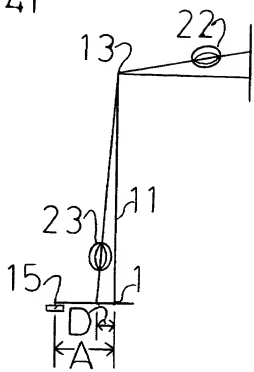

fig 43

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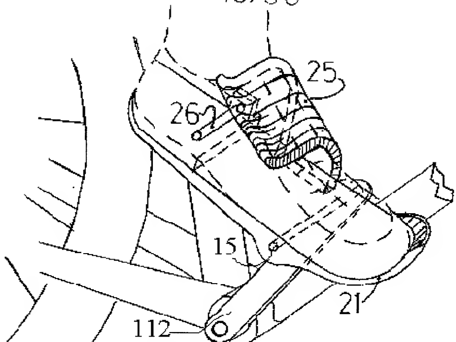

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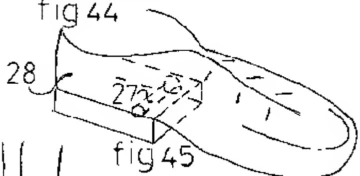

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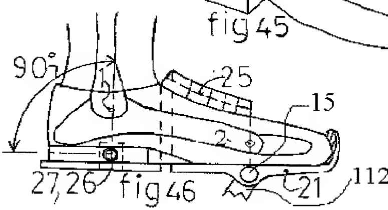

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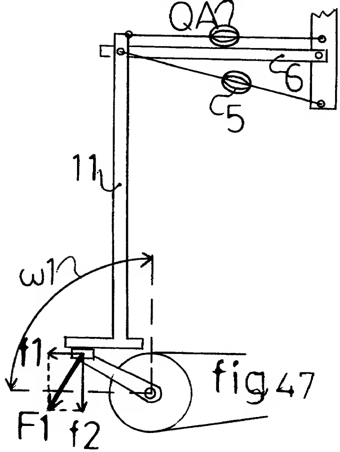

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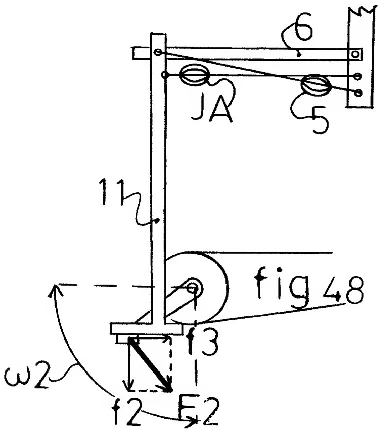

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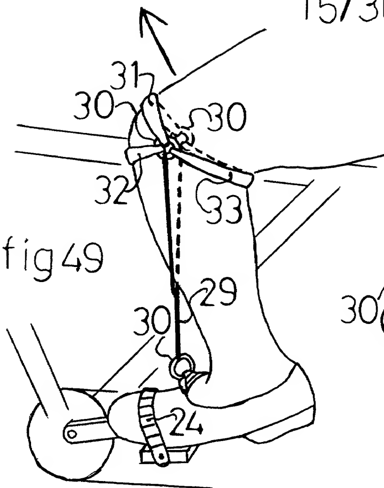

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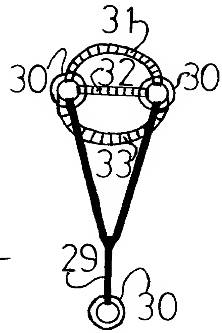

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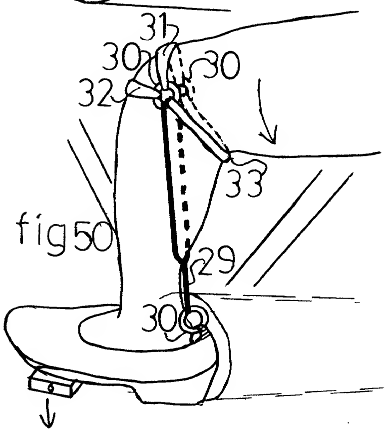

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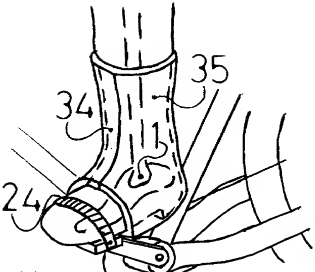

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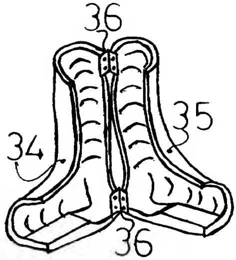

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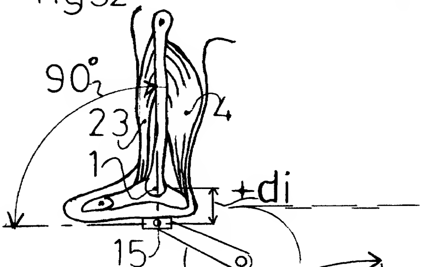

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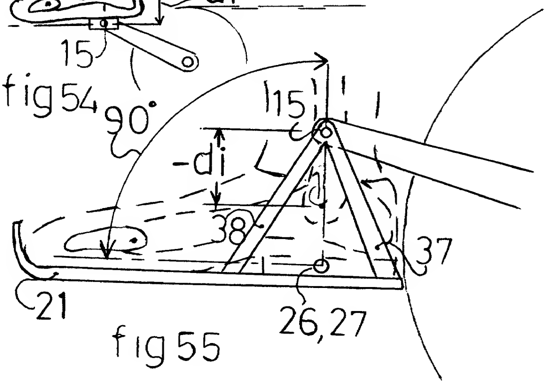

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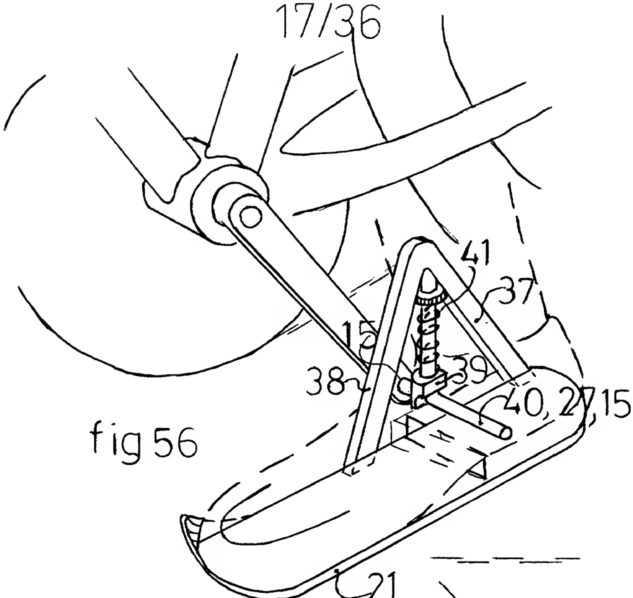

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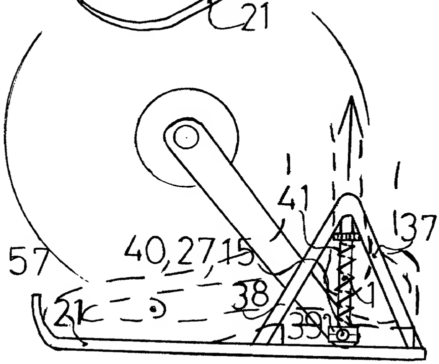

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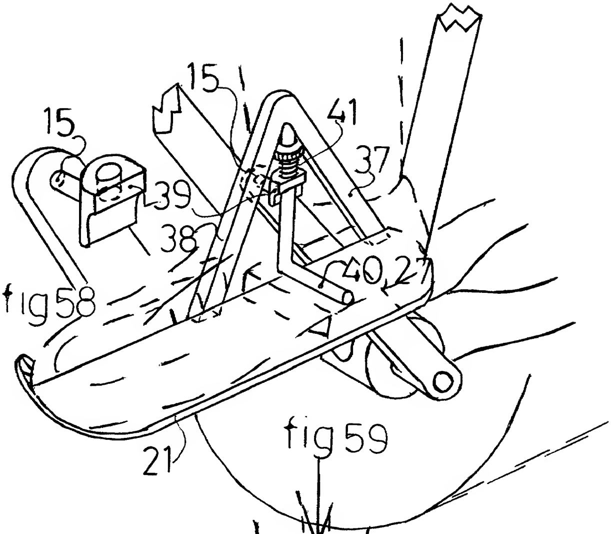


fig 58

fig 59

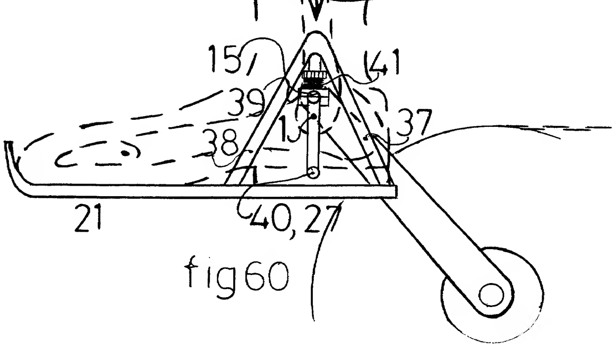
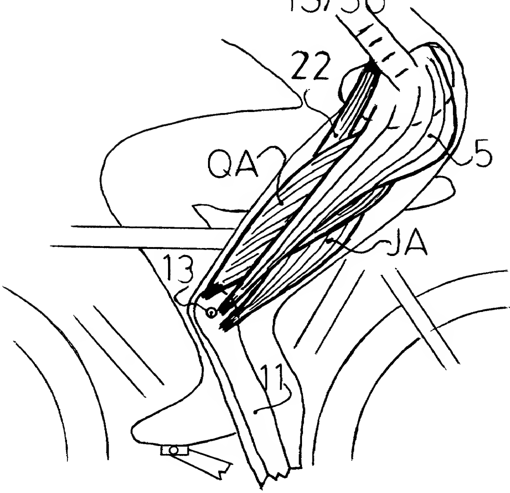


fig 60



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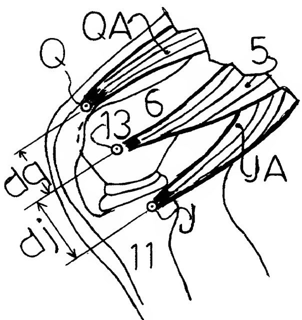
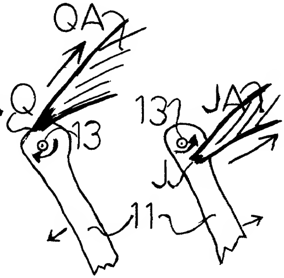


fig62



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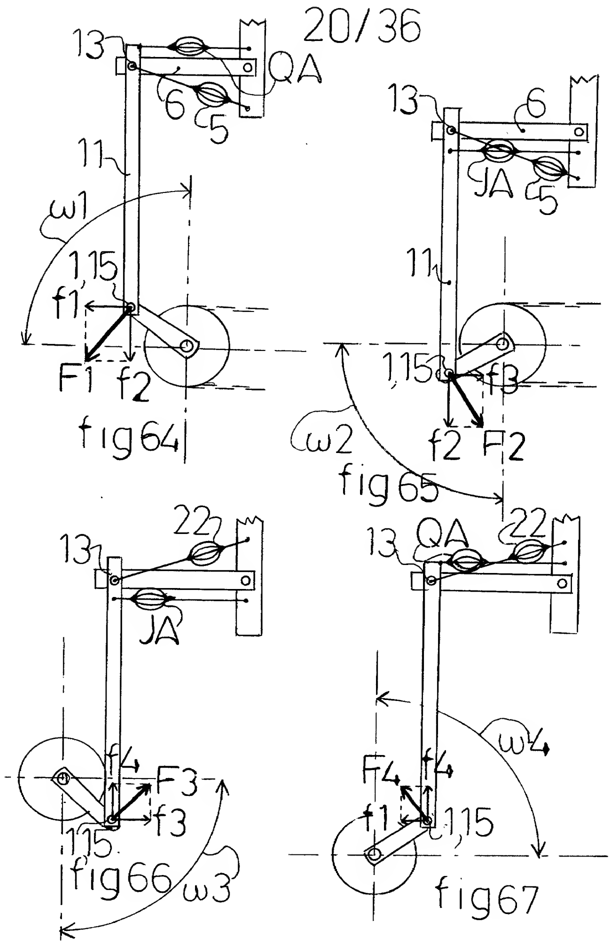
13
QA
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1,15
f1
F1
f2
fig 64
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f3
f2
F2
ω2
fig 65
22
13
JA
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F3
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1,15
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ω3
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ω4
F4
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f1
1,15
fig 67

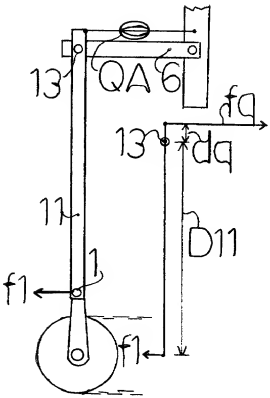

fig 68

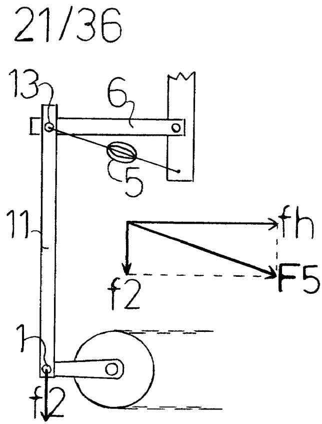

fig 69

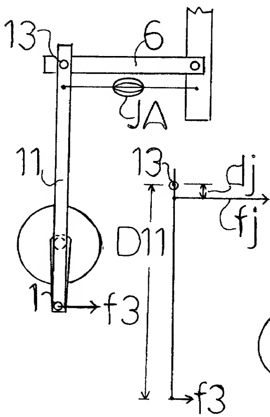

fig 70

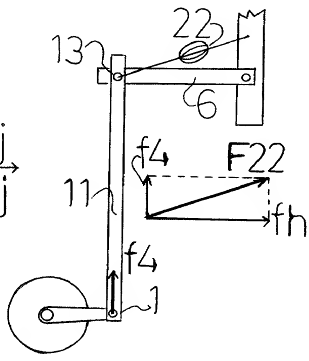

fig 71

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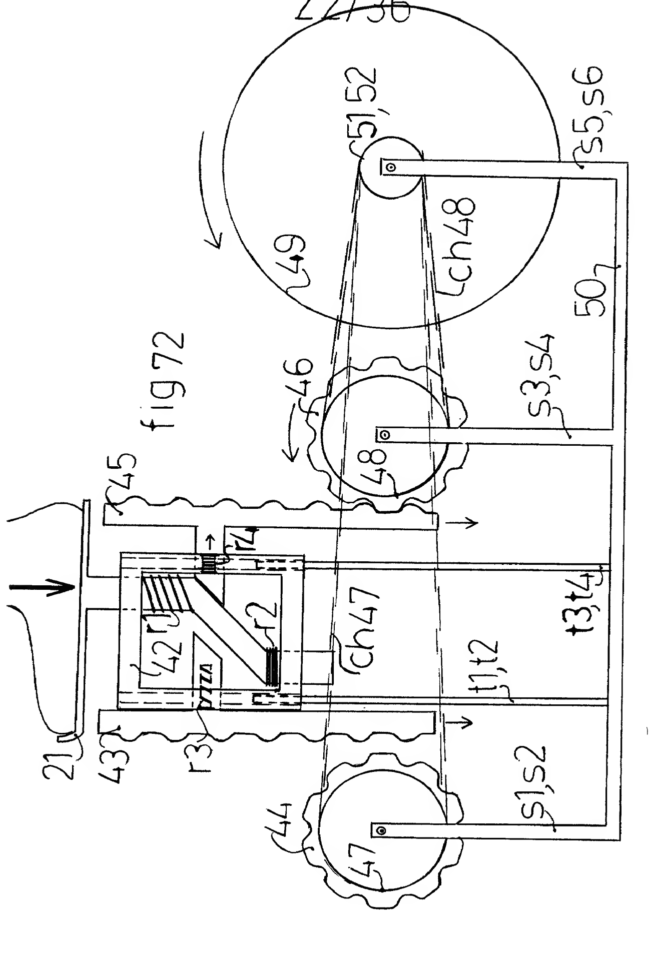
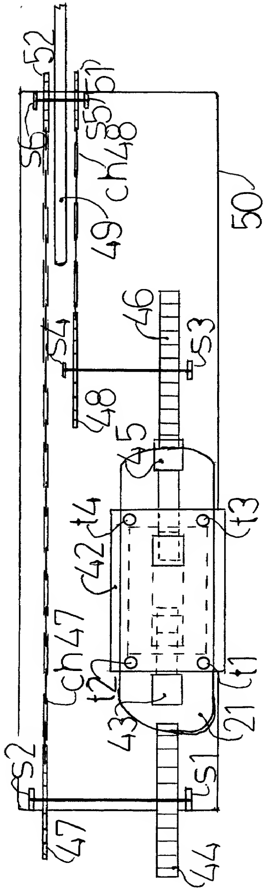


fig 72


52
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s2
s1
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fig 73

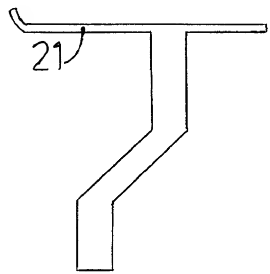
21

fig 74

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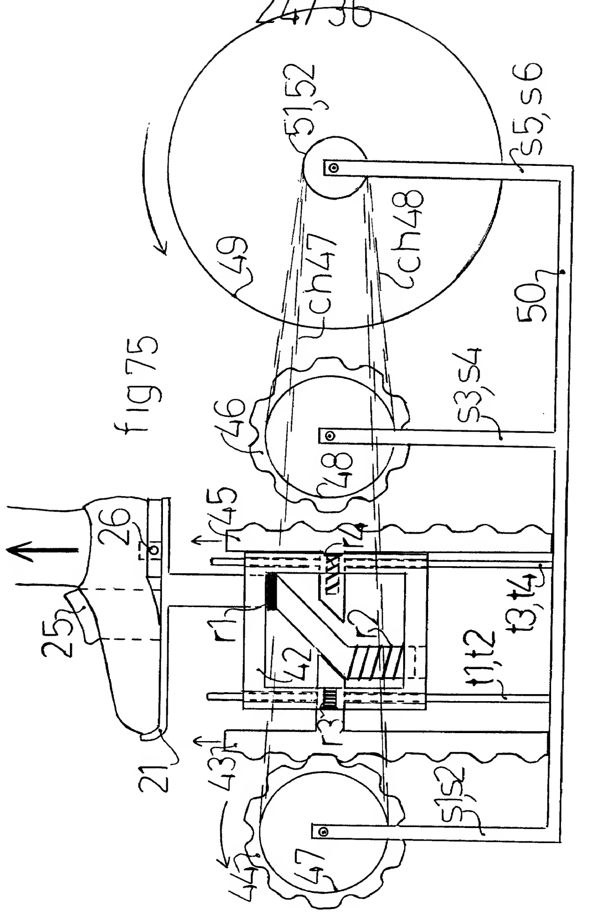

fig 75

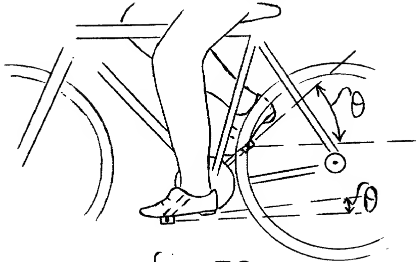

fig 76

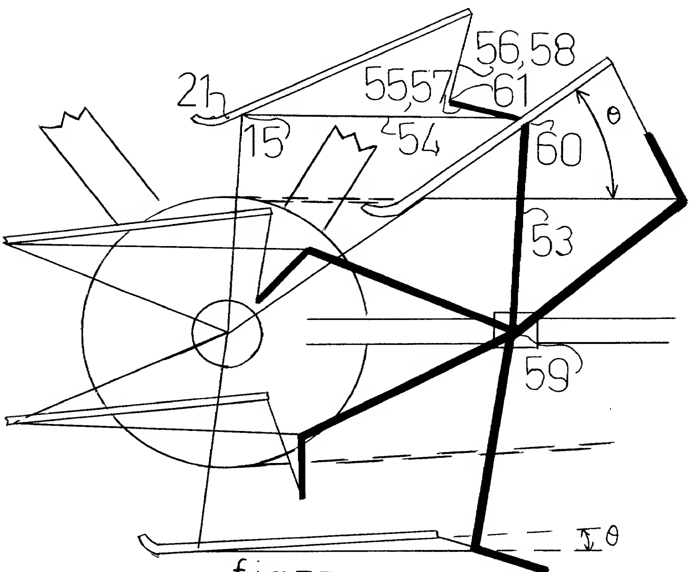

fig77

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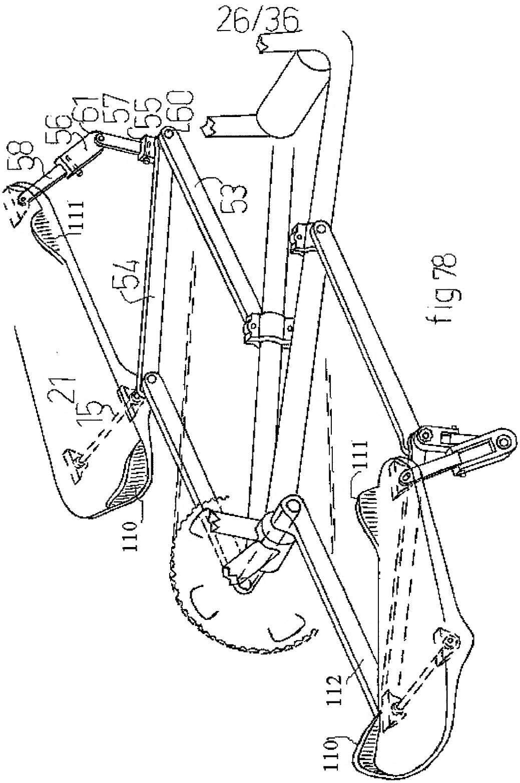

fig 78

09/830840

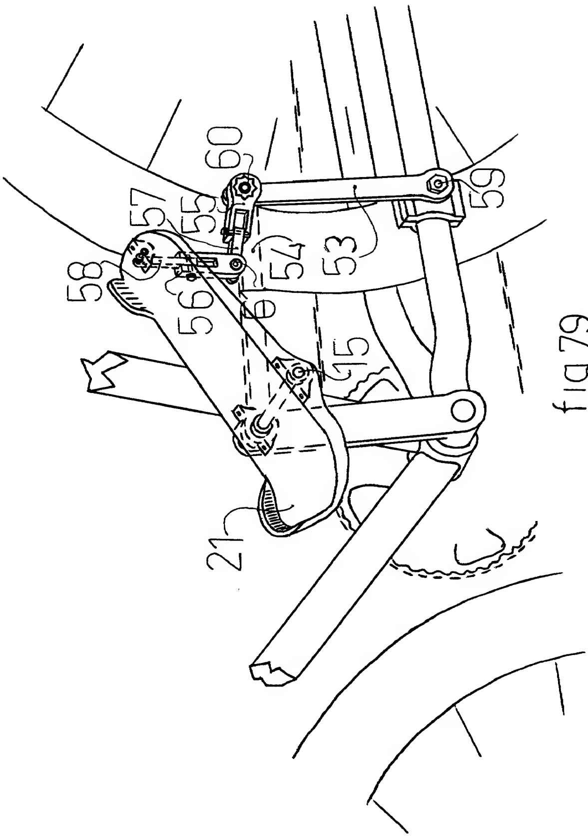

fig 79

09/830840

28/36

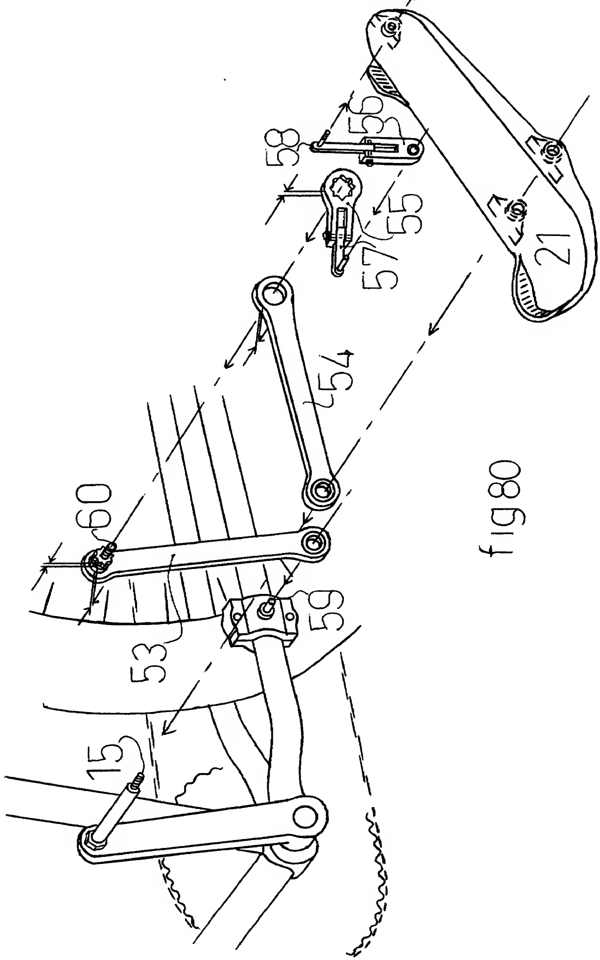

fig80

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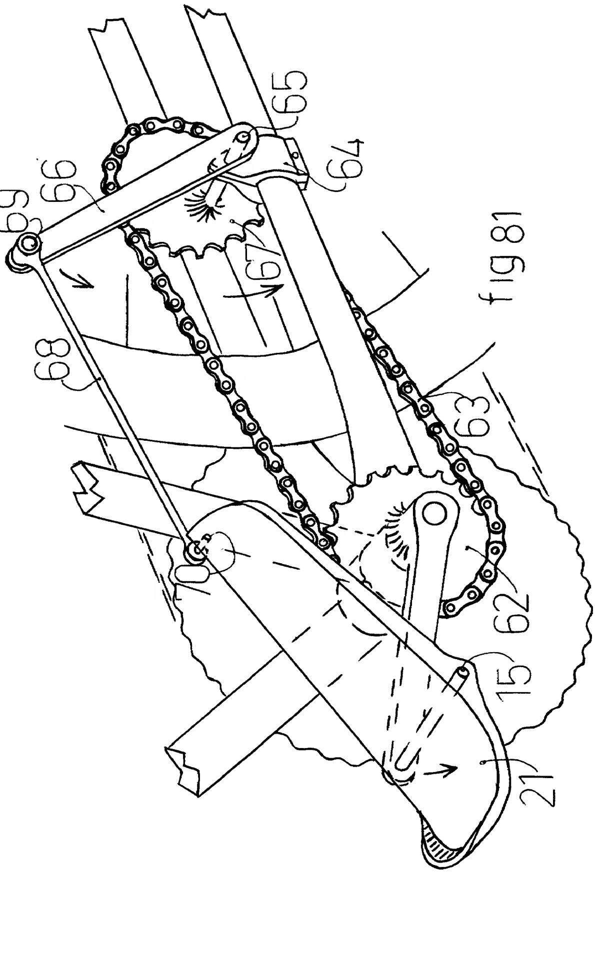

fig 81

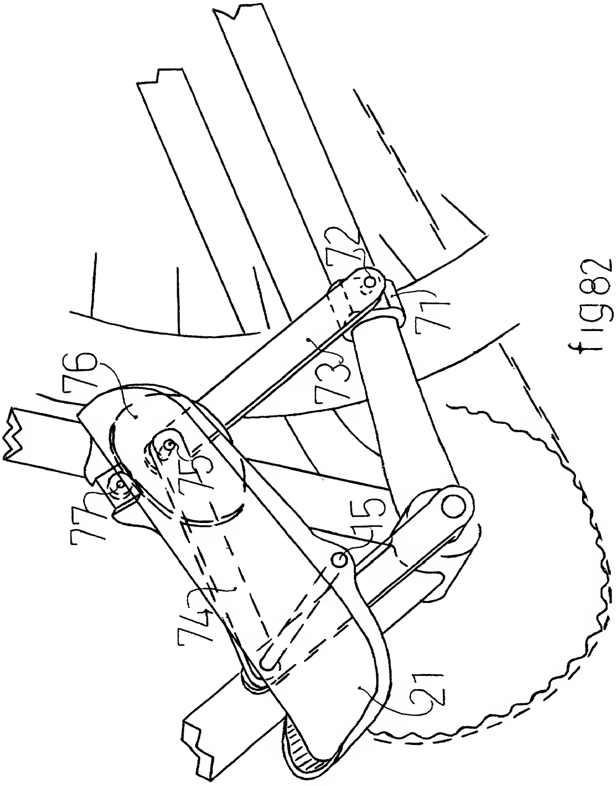

fig82

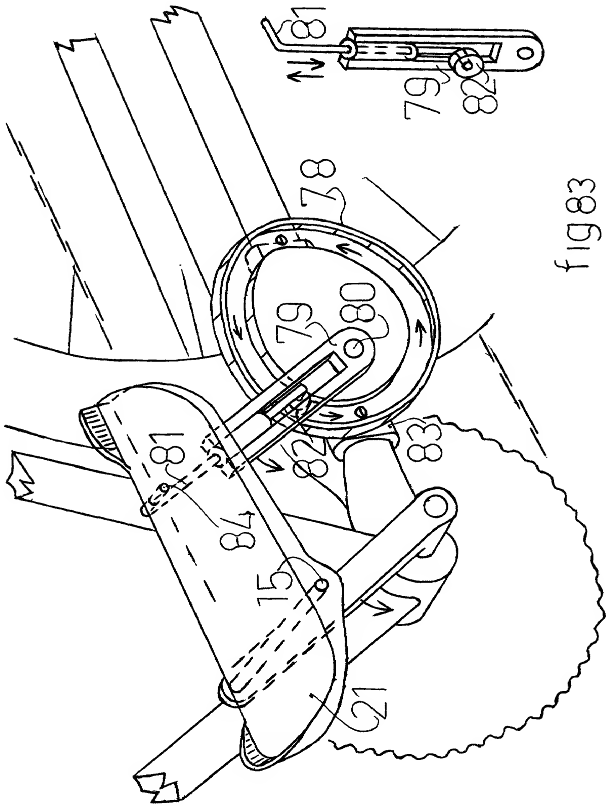

fig83

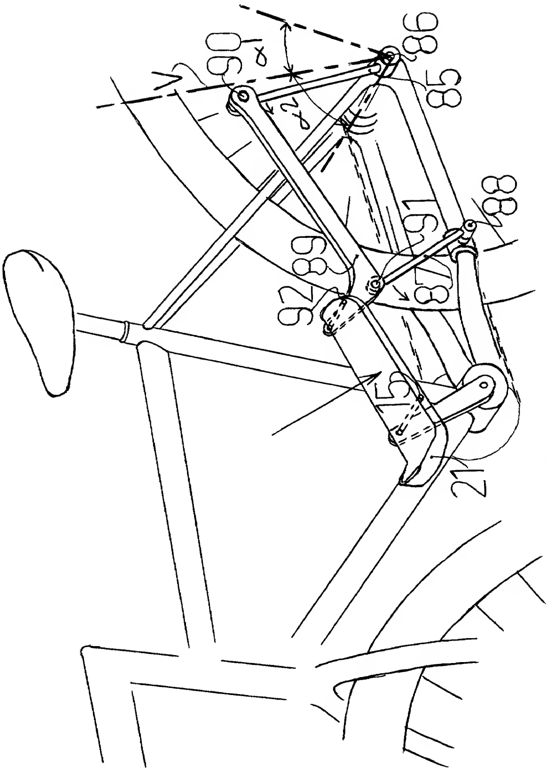

fig84

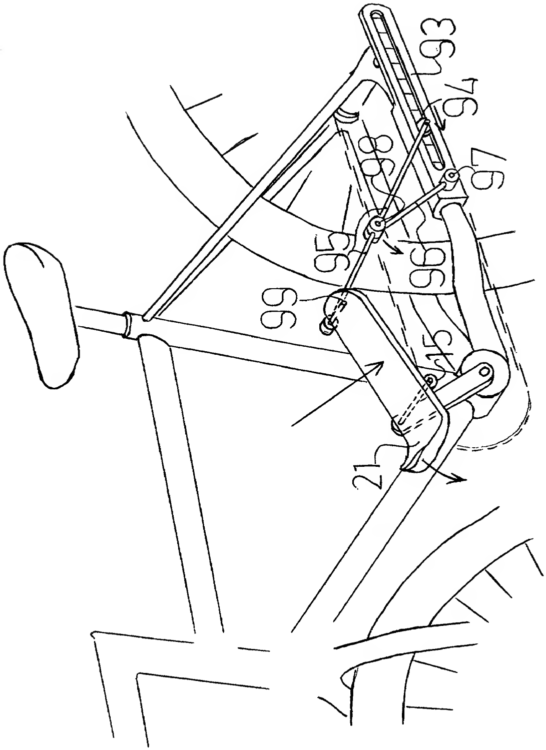

fig 85

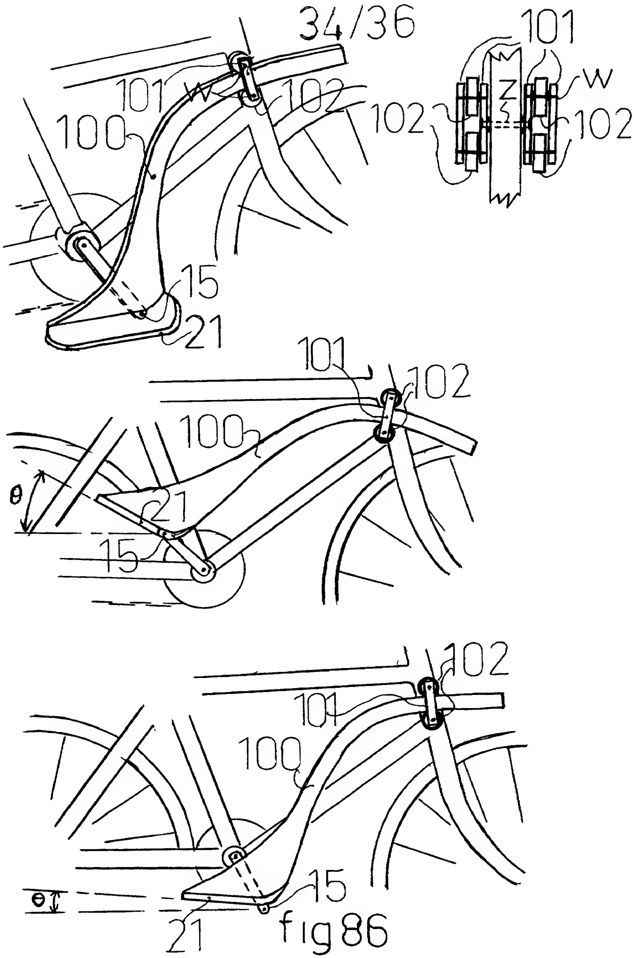
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fig 86

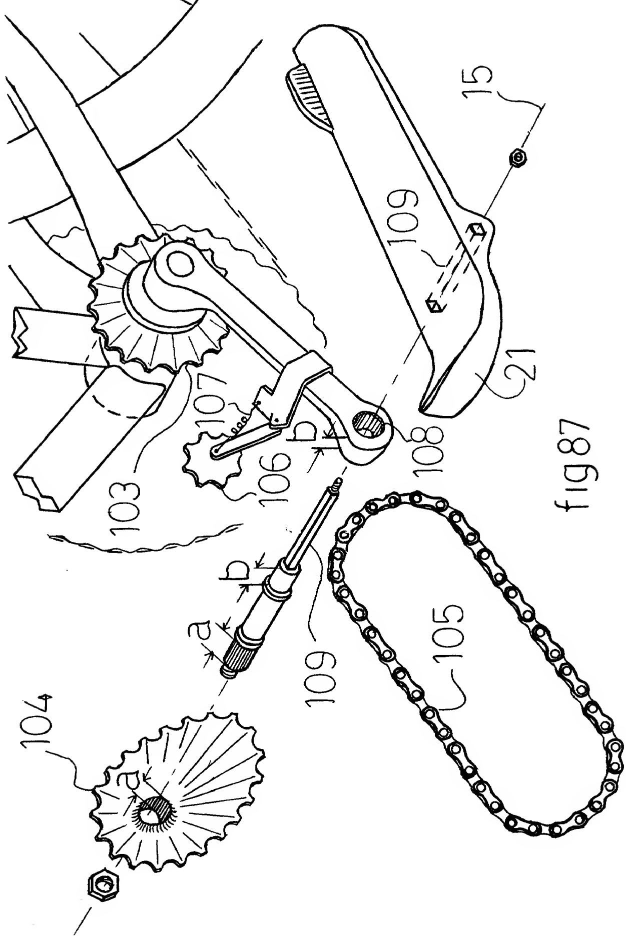

fig87

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09/830840

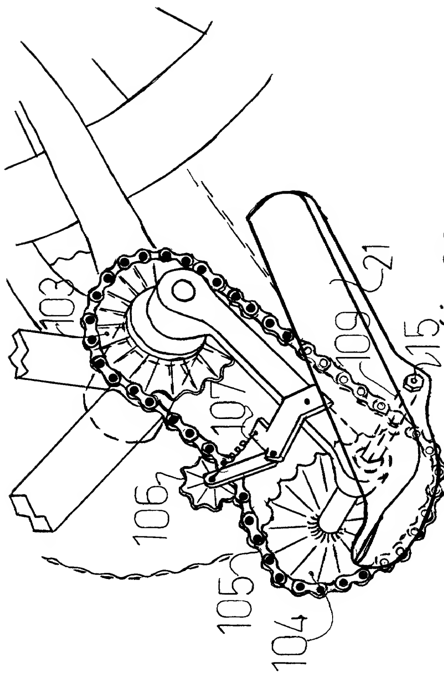

fig 88

Please type a plus sign (+) inside this box → [+]

DECLARATION FOR UTILITY OR DESIGN PATENT APPLICATION (37 CFR 1.63)

[X] Declaration Submitted with Initial Filing OR [ ] Declaration Submitted after Initial Filing (surcharge (37 CFR 1.16 (e)) required)

Attorney Docket Number	
First Named Inventor	ANDRÉ JACQUES
COMPLETE IF KNOWN	
Application Number	/
Filing Date	
Group Art Unit	
Examiner Name	

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

PROOF THAT THE CONTRACTION OF THE CALF CANNOT INCREASE PRESSURE ON THE PEDAL AND MECHANISMS CAPITALIZING ON THIS FUNDAMENTAL DISCOVERY

(Title of the Invention)

the specification of which

[X] is attached hereto

OR

[ ] was filed on (MM/DD/YYYY) [ ] as United States Application Number or PCT International Application Number [ ] and was amended on (MM/DD/YYYY) [ ] (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached? YES	NO
CA 2253014	CANADA	11/10/1998	[ ]	[ ]	[ ]
			[ ]	[ ]	[ ]
			[ ]	[ ]	[ ]
			[ ]	[ ]	[ ]

[ ] Additional foreign application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto:

I hereby claim the benefit under 35 U.S.C. 119(e) of any United States provisional application(s) listed below.

Application Number(s)	Filing Date (MM/DD/YYYY)	
		[ ] Additional provisional application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

André Jacques

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PTO/SB/01 (12-97)
Approved for use through 9/30/00. OMB 0651-0032
Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

DECLARATION — Utility or Design Patent Application

I hereby claim the benefit under 35 U.S.C. 120 of any United States application(s), or 365(c) of any PCT international application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. Parent Application or PCT Parent Number	Parent Filing Date (MM/DD/YYYY)	Parent Patent Number (if applicable)
PCT/CA99/01020	11/03/1999	

☐ Additional U.S. or PCT international application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

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OR
☐ Registered practitioner(s) name/registration number listed below

Name	Registration Number	Name	Registration Number

☐ Additional registered practitioner(s) named on supplemental Registered Practitioner Information sheet PTO/SB/02C attached hereto.

Direct all correspondence to: ☐ Customer Number or Bar Code Label [ ] OR ☒ Correspondence address below

Name	ANDRÉ JACQUES				
Address	P.O. Box 461				
Address					
City	L' ANNONCIATION	State	QC	ZIP	J0T 1T0
Country	CANADA	Telephone	613-275-1514	Fax	

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Name of Sole or First Inventor: ☐ A petition has been filed for this unsigned inventor

Given Name (first and middle [if any])	Family Name or Surname
ANDRÉ	JACQUES

1=00

Inventor's Signature	André Jacques					Date	5/02/2001
Residence: City	L' ANNONCIATION	State	QC	Country	CANADA CAX	Citizenship	CAN
Post Office Address	P.O. Box 461 J0T 1T0						
Post Office Address							
City		State		ZIP		Country	

☐ Additional inventors are being named on the ___ supplemental Additional Inventor(s) sheet(s) PTO/SB/02A attached hereto.